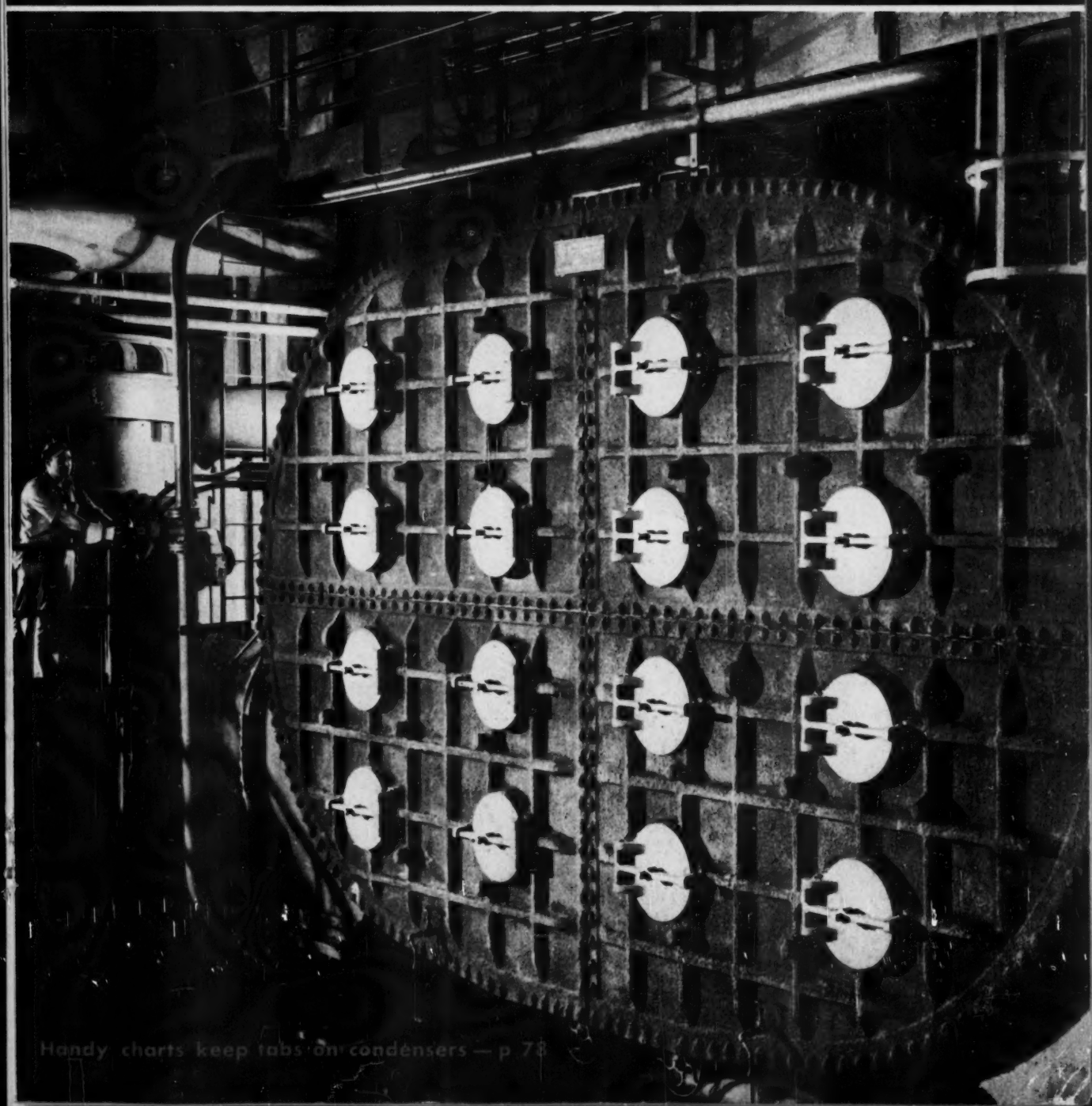
GENERATION, TRANSMISSION AND APPLICATION OF THE POWER SERVICES • A McGRAW-HILL PUBLICATION

Power

August
1953·50¢



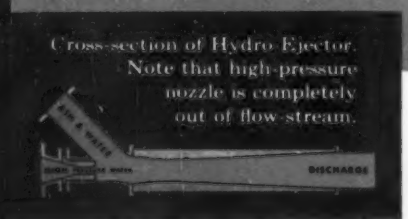
Handy charts keep tabs on condensers — p 78

The A-S-H Hydro-Ejector System

removes ashes at low cost

Operation

Furnace ash is driven into the clinker grinder by water jets in ash hopper. After passing through the grinder, the ashes are jetted into the inlet of the Hydro-Ejector by an auxiliary nozzle. The high-pressure jet then forces the ash through the system.



Cross-section of Hydro-Ejector. Note that high-pressure nozzle is completely out of flow-stream.

Typical Hydro-Ejector installation

Low initial investment

Economical operation and maintenance

These are the vital, cost-cutting advantages that the A-S-H Hydro-Ejector System offers you because of its simple, clean design and the use of special wear-resistant alloys throughout. If your operating conditions permit its application, you can slash your ash-disposal budget right from the start. A list of plants where Hydro-Ejector Systems are now operating will be gladly sent on request . . . . Regardless of the size of your plant, there's an A-S-H jetting, pumping, or pneumatic system to help you save your disposal dollar. Let our engineers tell you how.

THE ALLEN-SHERMAN-HOFF CO.

Dept. A—259 E. Lancaster Ave., Wynnewood, Pa.

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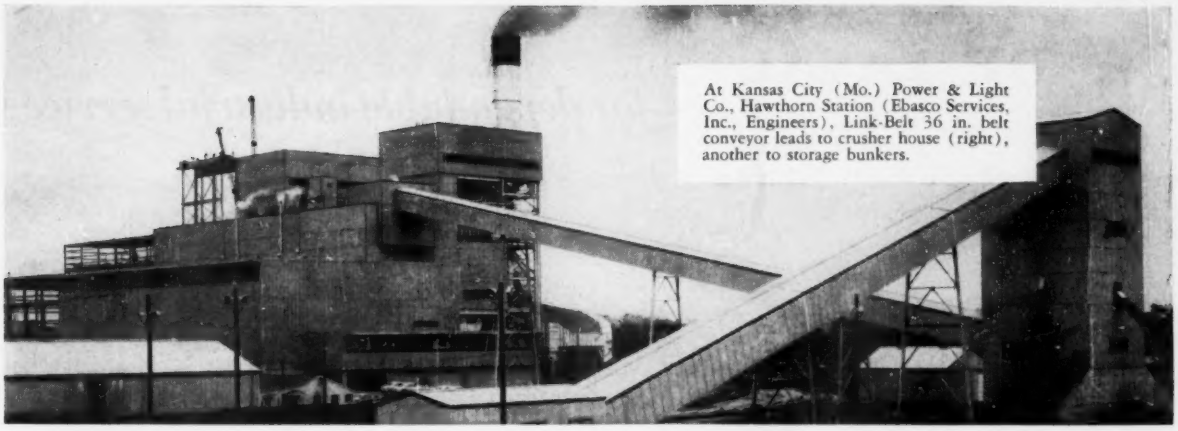
HYDROJET (hydraulic) HYDROVAC (pneumatic)

materials handling systems



At Kansas City (Mo.) Power & Light Co., Hawthorn Station (Ebasco Services, Inc., Engineers), Link-Belt 36 in. belt conveyor leads to crusher house (right), another to storage bunkers.

For the best in coal handling look to LINK-BELT

IN many power plants—large and small—Link-Belt engineers have met practically every type of coal handling problem. This vast experience, combined with the most complete line of coal handling equipment, is your assurance of the right system for your needs. Our engineers will work with you and your consultants—help you cut coal handling costs to a minimum. Write for 44-page Book 2410, containing drawings and photographs of many outstanding coal handling systems.

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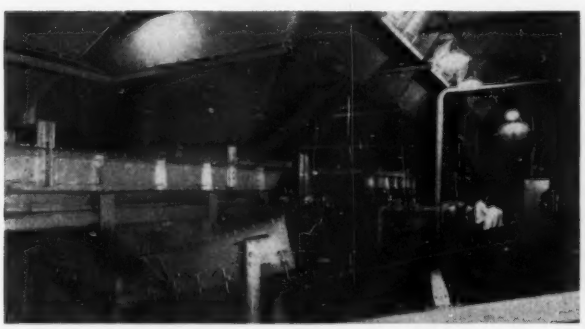
LINK-BELT

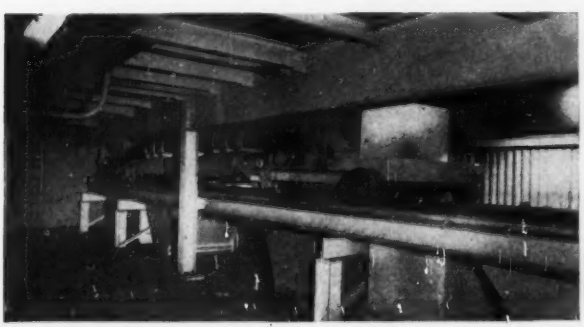
COAL HANDLING EQUIPMENT

13,255



Two Link-Belt double reciprocating feeders empty track receiving hoppers. Two belts feed another leading to crusher house.

One of two Link-Belt belt conveyors emptying track hoppers. At right, belt feeders deliver coal from reclaim hoppers.

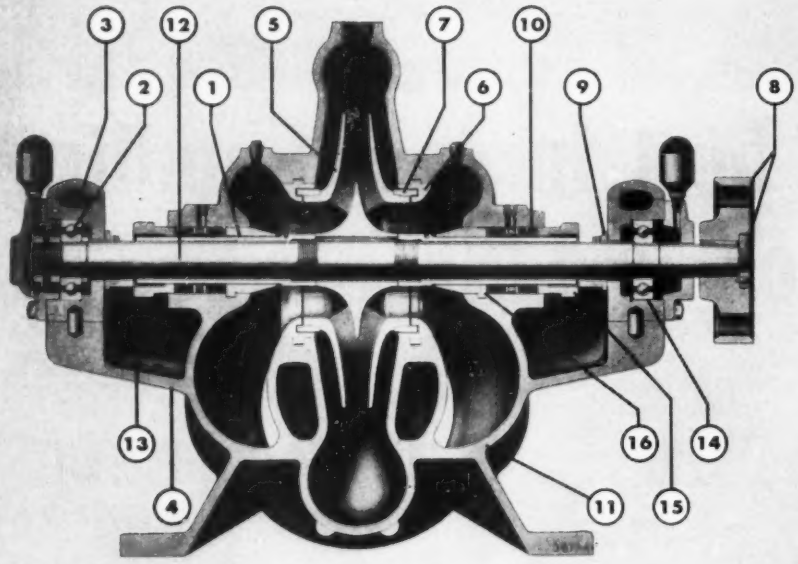


Shuttle belt transfers coal to distributing belts or storage bunkers directly. System handles 450 tph with provision for 900 tph.

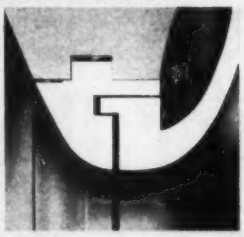
Self-propelled trippers have bunker seals. Drag chains in steel enclosures collect dribble from conveyor's return run.

DE LAVAL
SINGLE STAGE CENTRIFUGAL PUMPS

for dependable industrial service



Labyrinth wearing rings minimize leakage...maintain high efficiencies



Labyrinth rings used in these De Laval pumps retard flow of water through labyrinth passage.

Flat rings showing relatively unimpeded flow of water.

① **Shaft Sleeves** are screwed on, to abut the impeller and make a water-tight joint. Sleeve expands freely and independently of shaft when temperatures change. There is no tendency to buckle.

② **Thrust Bearing** locates rotor axially.

③ **Bearing Caps** easily removable for maintenance.

④ **Bearing Brackets** scraped to lining bars for perfect alignment.

⑤ **Impeller** hydraulically balanced, finished on all surfaces.

⑥ **Labyrinth Wearing Rings** held accurately in machined grooves in both case and cover.

⑦ **Impeller Wearing Rings** threaded on impeller, opposite to rotation.

⑧ **Flexible Coupling** ground on all exposed surfaces and statically balanced, complete coupling supplied, pump half mounted on taper so that it can be easily removed. Check nut locks coupling on taper.

⑨ **Deflector** keeps water out of bearing.

⑩ **Stuffing Boxes** extra deep; lantern rings for water sealing.

⑪ **Pump Case** horizontally split; machined to limit gages.

⑫ **Steel Shaft** ground to limit gages.

⑬ **Drip Boxes** large; provided with drain openings.

⑭ **Radial Bearing** free to move axially, thus avoiding temperature strains.

⑮ **Glands** split horizontally.

⑯ **Protecting Bushings** renewable.

You can count on the performance of the De Laval Single Stage Centrifugal Pumps because they are precision-made to high manufacturing standards and incorporate the many quality design features shown in the cross-section.

They operate at high or low speeds, at high or low heads...with maximum efficiency.

For example, De Laval G, I and K Single Stage Double Suction Pumps have a capacity range of 175 gpm to 6,000 gpm, and heads to 300 feet. They are available in sizes ranging from 4" suction and 3" discharge to 14" suction and 12" discharge. Write for Bulletin 1002.

DeLaval also furnishes larger centrifugals for capacities up to 70,000 gpm.

DE LAVAL *Centrifugal Pumps*

DE LAVAL STEAM TURBINE COMPANY

Nottingham Way, Trenton 2, New Jersey

BL 198

Power

AUGUST 1953 • VOLUME 97 NUMBER 8

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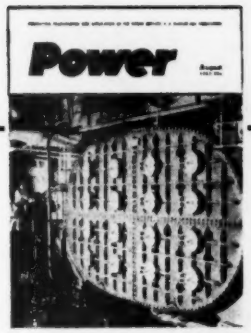
POWER articles are indexed in both the *Industrial Arts Index* and the *Engineering Index*. POWER publishes its own annual index, which is available for 50¢ from the editorial offices.



CONDENSERS must be kept in top shape or station output and efficiency suffer. Short of opening the unit, you can't see what goes on inside the shell. But, like a skillful doctor, you can diagnose conditions by interpreting external symptoms. In doing so, you'll find the nomograms and methods described on pp 78-81 useful timesavers.

Condenser pictured on our cover is a 100,000-sq-ft Allis-Chalmers unit in Commonwealth Edison Co's Ridgeland Station (POWER, April 1951, pp 84-87). It contains 14,550 30-ft tubes in single-pass divided-waterbox layout. At left of photo you see one of two vertical mixed-flow circulating pumps, each driven by a 700-hp motor. These units supply 155,000 gpm of cooling water. With 60 F water, condenser operates at approximately one inch Hg.

Next month . . .

■ Are you just a bit rusty on this business of "critical" pressure? We were, and so we did something about it. The result: a September article on the fundamentals, just what you need to prime you for coming big discussions on new super-pressure boilers.

■ Figuring stresses for high-temperature piping can be pretty tough but models make the job a lot easier. An upcoming story shows how models are used, what the method can do for you.

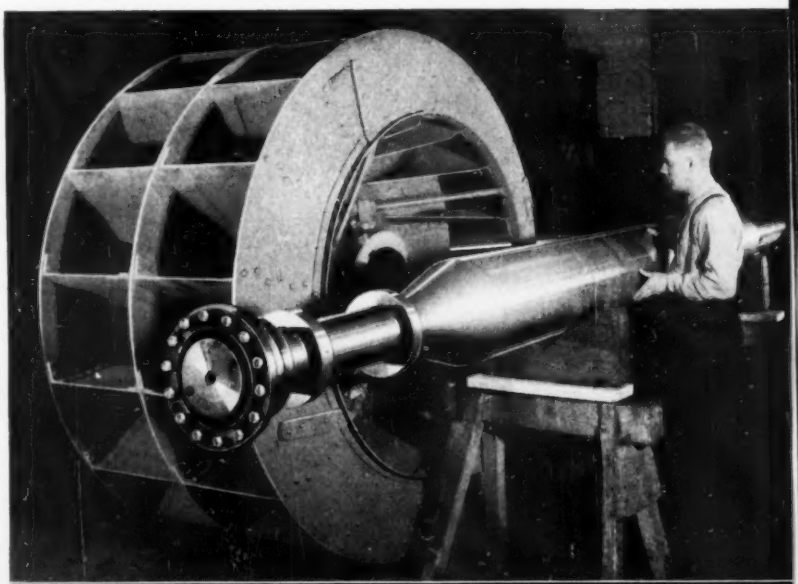
■ Want to do a better job of maintenance welding? Read Russ Kembel's September article on setting up a welding shop, using it to good advantage.

■ Coal handling, when it isn't done right, can be a mighty messy and expensive business. But mechanize the job fully, to make coal "flow," and you take all the grief out of it. For ideas on how to do it, see next month's industrial-plant case study.

. . . and future months

■ When you modernize your plant's electrical system, or start planning a new one, you don't want to miss any bets. And you won't, if you use our 52-pg October special report. It brings you the best thinking of top experts, and it's organized for easy reading and ready reference. Watch for it!

"Buffalo" Fan Features that Reduce DRAFT Costs



1 STRENGTH

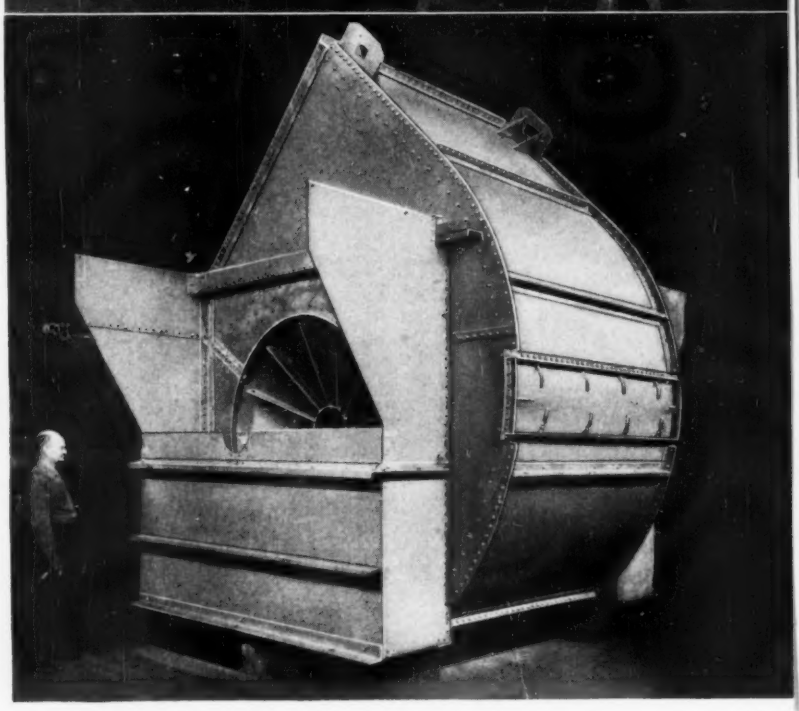
In such severe service as mechanical draft, the "cheapest" fan is the one that lasts longest. "Buffalo" Fans are built for the longest possible life. Note the heavy, rigid construction of the "Buffalo" rotor shown at right, and the oversized shaft turned from one solid steel forging, thrust collars and all. This is typical of the strength and endurance built into every "Buffalo" Draft Fan—strength that means far less repair and replacement cost through added years of service.

2 ENGINEERING

"Buffalo" Engineering "know-how" is back of the high efficiency and favorable pressure characteristics of "Buffalo" Forced Draft, Induced Draft and Primary Air Fans. These characteristics mean stable delivery over widely varying fuel requirements—minimum erosive action on Induced Draft—minimum driving power on all fans.

3 SERVICEABILITY

Accessibility of all parts is a "must" if servicing is to be done rapidly and economically. At right is a "Buffalo" Induced Draft housing, showing the sectional, bolted design and access hatch. Cleaning, coating, rotor balancing—even rotor removal—are greatly simplified.



For further features that give you lower draft costs—plus more dependable draft—write today for Bulletin 3750.

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PUBLISHERS OF "FAN ENGINEERING" HANDBOOK

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...with Power readers...

WHO HAS "STEAM"?

We're looking for bound volumes (or even single copies) of a magazine called Steam, *published in Chicago in the early 1880's. That's a long way back, so we don't imagine many subscribers are still around. But maybe someone bequeathed you a set. Or maybe you spotted some copies in a second-hand book store, bought them for antiquarian interest. Whatever their source, if you have copies of* Steam, *or know where there are some, you can do us a big favor by dropping a line to Phil Swain, Editor. Why our sudden interest? Well, read on . . .*

ARE WE OLDER THAN WE THOUGHT?

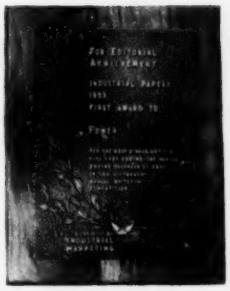
POWER was founded in 1884—the first issue appeared in November. All our information has told us, for years, that it was incorporated with a magazine called *Steam*, which had begun publication in October, 1882. So you can figure we were jolted to our eyeteeth when we recently ran across some puzzling evidence indicating that *Steam* may have been started in 1880.

The evidence is an editorial in the Dec 1890 issue of POWER. Under the heading "End of Volume X," it says "The close of the present volume marks a *decade* in the history of this paper . . ."

Now a decade is ten years. And ten from 1890 takes you back to 1880. Note also that

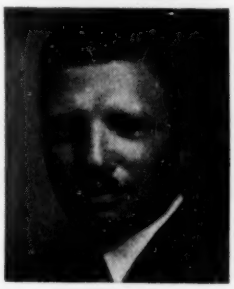
(*Continued on page* 192)

...lines and bylines



EDITORS, like just about everyone else, welcome a good solid pat on the back. Our special report on *Water* (Sept 1952) has had a heart-warming response—well over a thousand letters of commendation and requests for more than 8000 reprints. This kind of acceptance, from the readers we work for, is particularly gratifying.

We are also proud of recent recognition from our peers in the editorial field. As the photo at the right indicates, POWER's report on *Water* received first award in the 15th Annual Business Paper Editorial Achievement Competition sponsored by the magazine *Industrial Marketing*. From a field of 515 entries, a jury of 23 distinguished judges voted it *the best single article published in an industrial magazine during the year 1952*. So we have another plaque to join those recognizing past prize-winning editorial projects—and another mark to exceed in future efforts.

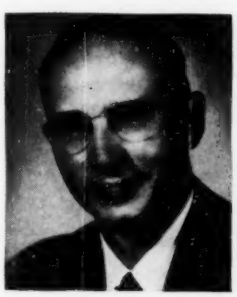


S B Applebaum

"DEAN" of the water-treating equipment field is a title often applied to Samuel Applebaum. It recognizes a lifelong career in external treatment of water for municipal, industrial and boiler-feed application—a career that began immediately after he received his engineering degree from Columbia University in 1913.

Now manager of Cochrane Corp's water-treatment division, Applebaum is a frequent contributor to engineering society proceedings. His papers have been published by ASME, ACS, American Water Works Assn, Engineers' Society of Western Pennsylvania and the American Power Conference. For some of his current thinking on demineralization, see the survey article on pp 88-91.

Formerly a member of the New York Tennis Club and Adirondack Mountain Club, Applebaum now spends much of his spare time in gardening, photography and sketching. But water treatment—developing new methods and applying them—has always been his main hobby.



Frank Ptacek

STEAM SPECIALTIES are *the* specialty of Frank Ptacek, asst to the sales manager of Yarnall-Waring Co. A graduate of Cornell (ME), Frank served as asst supt of Eastwood Nealley Wire Co before joining Yarway in 1941.

His present job takes him into many of the large steam power and process plants of the country and gives him plenty of chances to observe the performance of the various steam specialties. It's out of this experience that he speaks in the article on selection and application of water-level gages for medium- and high-pressure boilers, pp 82-84. Besides contributing to technical magazines, Frank is active in ASME, Cornell Society of Engineers, American Pulp and Paper Mill Supts' Assn.

Proud parents of two young daughters, he and Mrs Ptacek do their share (and a little more, if we know Frank) in community activities. When time permits, he heads outdoors for hiking and swimming.

5500
pounds pressure
B&W UNIVERSAL
SMASHES
THROUGH
2650
pounds
pressure
650
pounds
pressure
PHILO
PLANT
1922
TWIN
BRANCH
STATION
1937
PHILO
PLANT
1953
THE B&W
UNIVERSAL
PRESSURE
BOILER

PRESSURE BOILER

THE PRESSURE CEILING

To bring new efficiency levels in steam-electric generation

Progress toward the greatest possible efficiency in power generation has taken a spectacular stride with the development of the B&W Universal Pressure Boiler unit that will utilize unprecedented pressures and steam temperatures . . . will make possible the most efficient steam-electric generating unit ever built.

Through cooperative research and development, efficiency of power generation in the United States has been advancing steadily. However, across the path of development stood the critical pressure . . . 3206 psi . . . beyond which steam and water could no longer be separated. If further important economies were to be achieved, this barrier had to be broken. Only by going to pressures far beyond anything being used could new and broader avenues to greater economy be opened. This is the significance of the Universal Pressure Boiler and the new turbo-generator installation for the Philo Plant of the Ohio Power Company.

In 1923, the earliest Reheat Unit in the country, generating 40,000 kw, was installed at the Philo Plant. Its design pressure was 650 psi with initial steam temperature of 750F. By 1937, a new record high pressure—2650 psi drum design, with 940F at the superheater outlet—was established with a B&W Open-Pass Boiler for Twin Branch Station of Indiana & Michigan Electric Company. And now, again at Philo Plant, *in the same building and on the existing foundation of the original 40,000 kw unit,* the new B&W Universal Pressure Boiler, with a turbo-generator operating at 4500 psi and 1150F, will produce 120,000 kw, in the same space and using 45% less fuel per kilowatt-hour.

Smashing through the pressure ceiling—3206 psi—is a culminating achievement typical of the imaginative daring which has marked previous advances in economy of steam-electric generation. It opens a new era for the American utility industry.

The new B&W UNIVERSAL PRESSURE BOILER will be of the once-through type in which water at 5500 psi will be pumped through and changed into superheated steam in a single fast passage through the boiler tubes. Steam at 4500 psi and 1150 F—almost double the current highest steam pressure and 50 F above the present highest temperature—will spin the specially designed turbo-generator.

Two stages of reheat will be employed in the boiler—the first at 1150 psi and 1050 F and the second at 165 psi and 1000 F—and it will be equipped with three B&W CYCLONE FURNACES to assure most rapid and complete combustion of the coal, with minimum maintenance and greatly reduced fly ash discharge from the stack.

The Universal Pressure Boiler accomplishes two vital savings:

1. By eliminating the steam drum and making possible a completely new concept of arranging heat absorbing surfaces, building requirements and erection costs will be materially reduced, bringing important savings in initial investment.

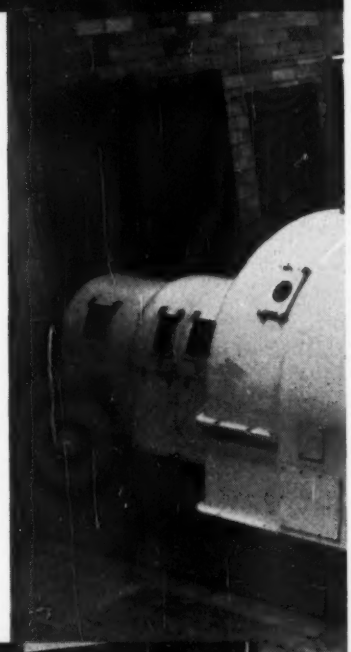
2. Radical reduction in fuel consumption through the use of a highly efficient steam cycle.

BABCOCK & WILCOX

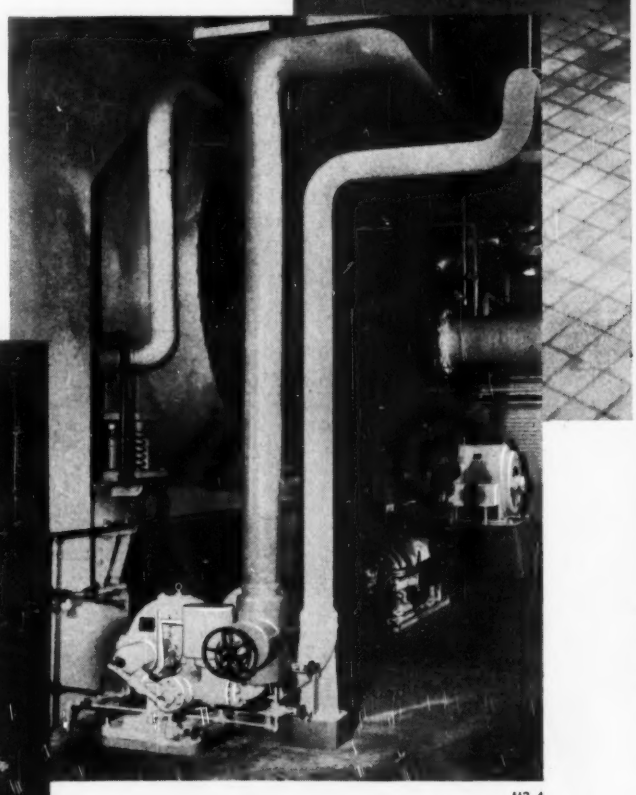
BOILER DIVISION

G-614

The *sixth* ELLIOTT unit

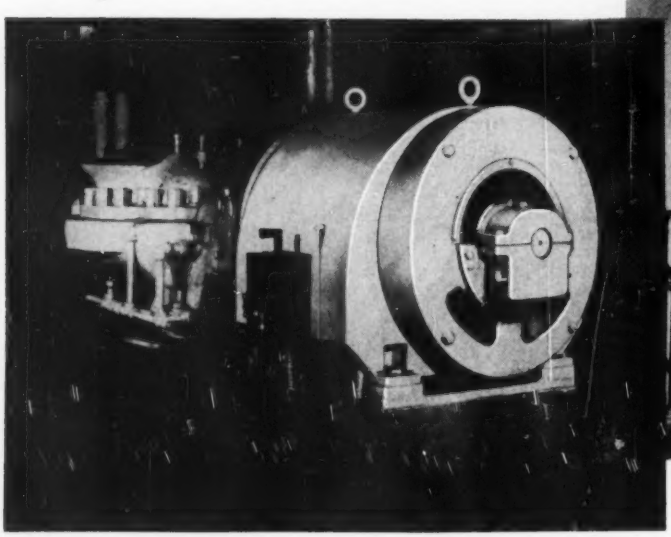


● Called a model plant, the Piqua, Ohio, utility has since its inception installed a succession of Elliott turbine-generator units. In 1933 two 4000-kw units started operation. Growing power demand brought the addition of another 4000-kw Elliott unit in 1939. Further expansion in 1946 saw the installation of a 7500-kw condensing turbine-generator and a 1000-kw noncondensing unit supplying process steam to an 8-in. distribution line. But Piqua continues to thrive and grow, dictating the recent installation of their largest unit, a 10,000-kw Elliott turbine-generator unit. Besides the turbine-generators, other major and auxiliary equipment in the Piqua plant is also Elliott, making the plant one in which Elliott Company feels a deep and abiding interest.



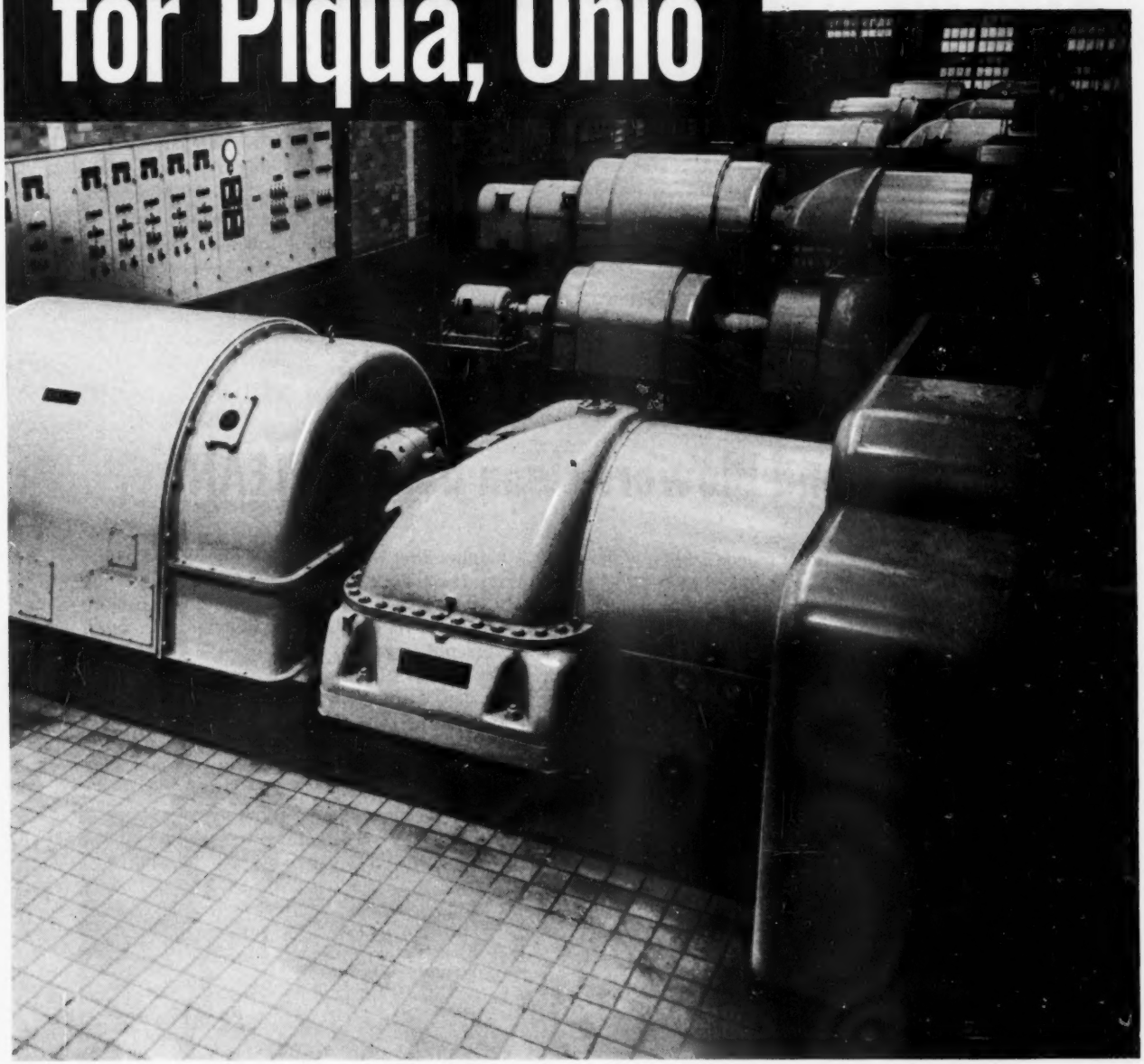
One end of the Elliott 12,000-sq ft divided water-box surface condenser which serves the new 10,000-kw turbine. In the immediate foreground, an Elliott 25-hp turbine, and in the middle distance, an Elliott 25-hp motor, both driving condensate pumps. In the background, an Elliott 200-hp motor driving an induced-draft fan.

Close-up of an Elliott 200-hp, 3600-rpm motor driving a boiler-feed pump.



H3-4

for Piqua, Ohio



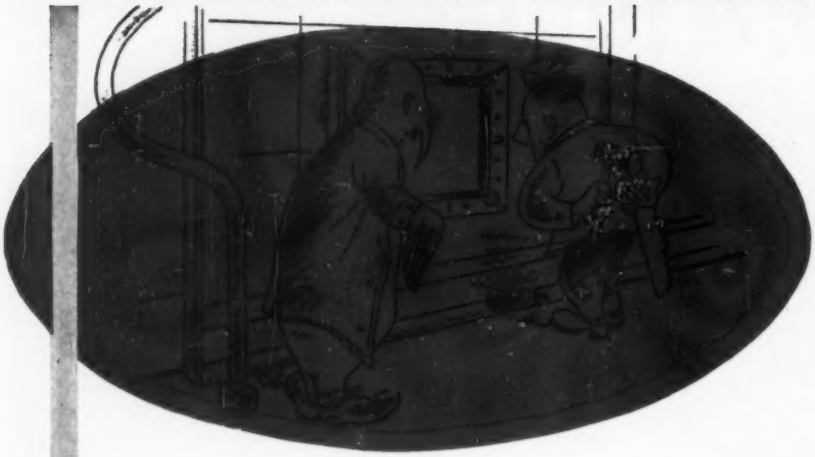
THE BIG PARADE of Elliott turbine-generators at Piqua began in 1933 with the two units in the far background of the above photo, continued through several more installations, and is brought up to date with the recent addition of the 10,000-kw turbine-generator unit in the immediate foreground.

For complete details on Elliott turbine-generators, contact your local Elliott representative or write Elliott Company, Jeannette, Pa.

ELLIOTT Company

STEAM TURBINE DEPARTMENT

Even the walrus should know...



"If fifty maids with fifty mops
Should sweep it hour by hour
Do you suppose," the Walrus said;
"That we could get more power?"
"I doubt it," said the Carpenter,
"We need a Diamond Blower."

. . . Apology to Lewis Carrol

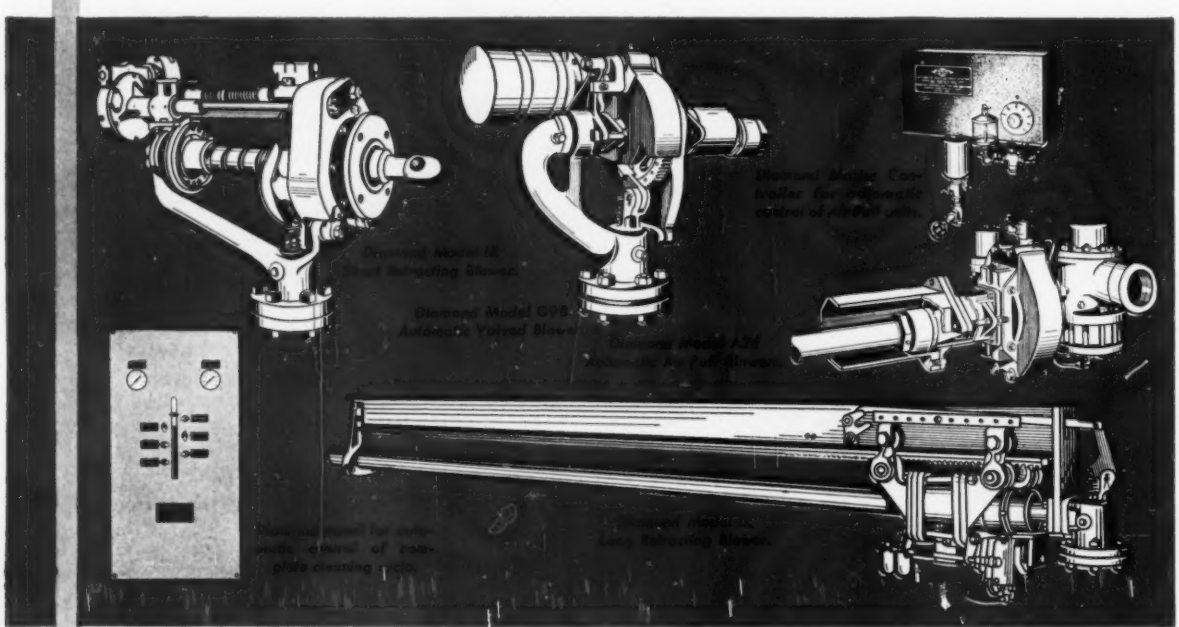
Diamond Blowers clean boilers CLEAN!

If you found a power plant manned by a walrus and a carpenter, it would be surprising. But not more surprising than would be a coal or oil fired plant without soot blowers.

Good soot blowers are an obvious necessity which no engineer questions these days. And increasing size and complexities of modern boilers make this necessity continually more and more urgent.

Another fact which is rarely questioned is the marked superiority of Diamond Blowers. Over the last 50 years we have made and applied more blowers for more boilers than all the other makers put together.

This wealth of experience, plus the most complete and varied line of blower units available anywhere, enables Diamond engineers to meet *any* boiler cleaning job with the right answer and the right equipment.



DIAMOND POWER SPECIALTY CORP.

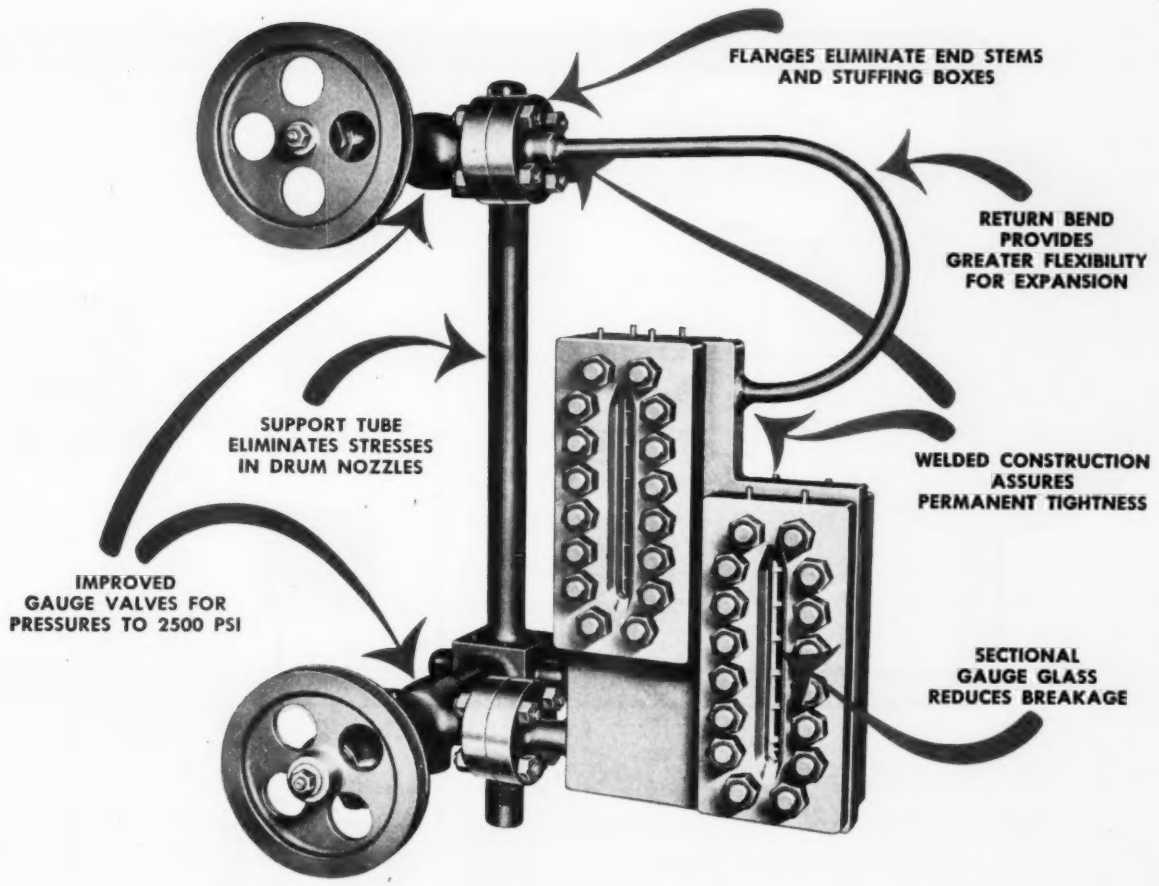
LANCASTER, OHIO

Diamond Specialty Limited, Windsor Ontario

6150

New DIAMOND Flange Connected WATER GAUGES

More Suitable to High Pressure Operation


FLANGES ELIMINATE END STEMS AND STUFFING BOXES
RETURN BEND PROVIDES GREATER FLEXIBILITY FOR EXPANSION
SUPPORT TUBE ELIMINATES STRESSES IN DRUM NOZZLES
WELDED CONSTRUCTION ASSURES PERMANENT TIGHTNESS
IMPROVED GAUGE VALVES FOR PRESSURES TO 2500 PSI
SECTIONAL GAUGE GLASS REDUCES BREAKAGE

In addition to the advantages shown above, this gauge provides maximum level visibility with minimum drum nozzle spacing. Greater reading accuracy is another important feature. The bend (which is uninsulated) provides sufficient condensing area to assure active circulation of hot condensate through the gauge. This maintains the gauge at higher temperature so there is less difference between boiler water and gauge water density. That and the shorter gauge assure greater accuracy.

Write for new Bulletin No. 1051V describing Diamond Water Gauges and Water Columns.

DIAMOND POWER SPECIALTY CORPORATION

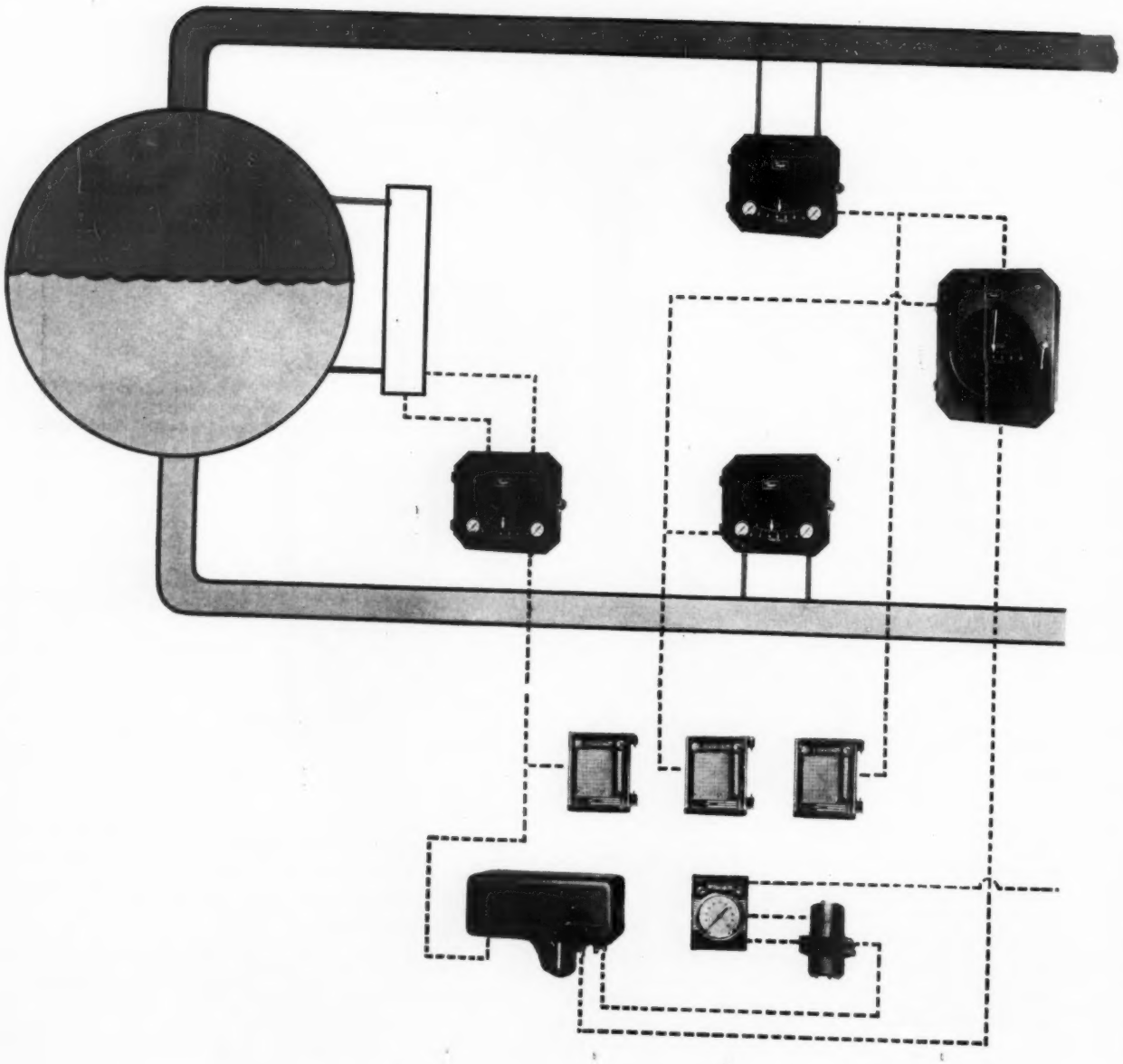
LANCASTER, OHIO

Diamond Specialty Limited—Windsor, Ontario

4860

From the oldest

IN THREE-INFLUENCE

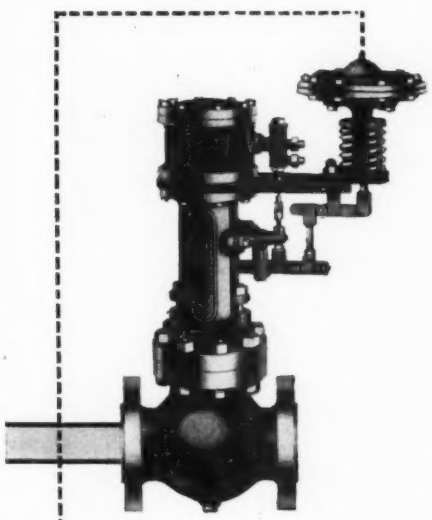


comes the newest

BOILER FEED WATER CONTROL

COPES *type 3-L*

with instrumentation by Taylor



COPES . . . the *oldest* name in boiler feed water regulation . . . now offers you the *newest* in three-influence feed water control. Combined in the new COPES Type 3-L are . . .

. . . the scientific balance, the characterized ports and the rugged dependability of the COPES control valve

. . . plus the unequalled responsiveness and accuracy of *instrumentation by Taylor*

And Copes-Vulcan assumes undivided responsibility for service, whenever or wherever needed . . . throughout the life of the installation. *Write for Bulletin 1013.* It tells the story of the newest feed water control to come from COPES . . . the oldest name in boiler feed water regulation.

COPES-VULCAN DIVISION

CONTINENTAL FOUNDRY & MACHINE COMPANY

ERIE 4, PENNSYLVANIA

Three-influence mechanically-operated and three-influence electrically-operated regulators are also available.

COPES VULCAN BOILER CONTROL

WITH INSTRUMENTATION BY *Taylor*

at WABASH RIVER

BOILER DATA

Steam Generators.....Foster Wheeler Reheat Type

Capacity, each..700,000 lb per hr

Operating Pressure.....1500 psig

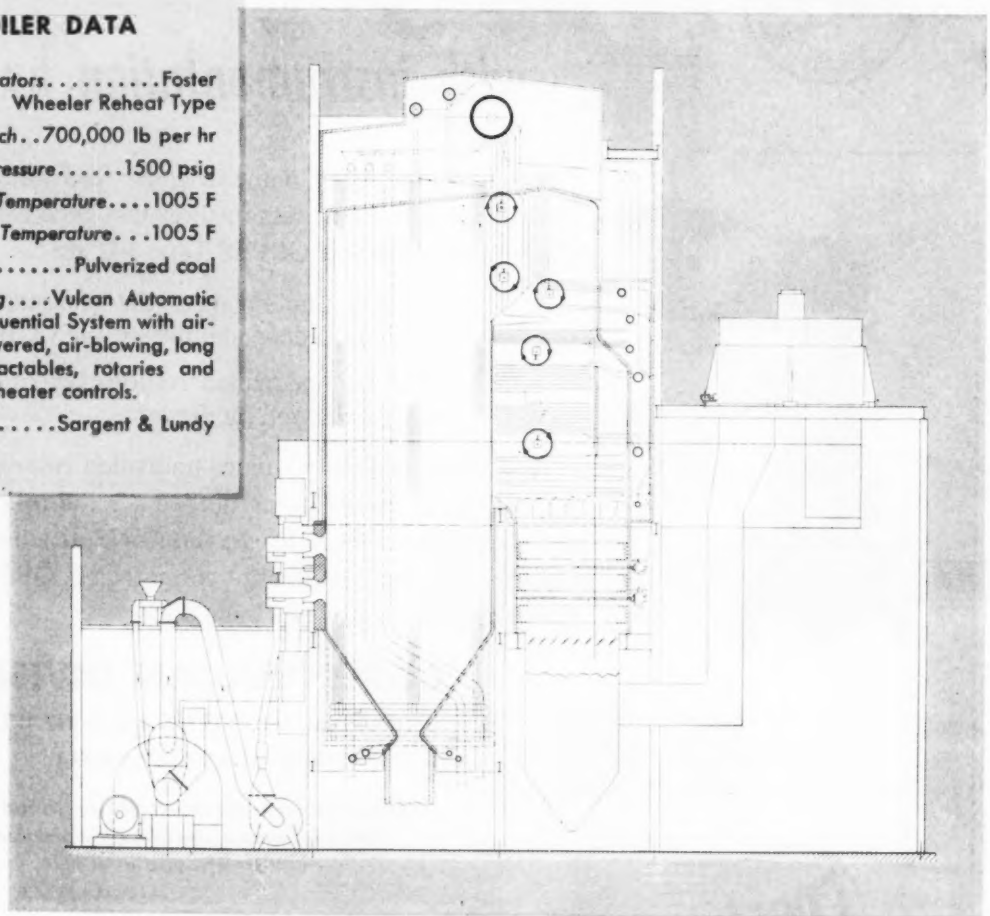
Final Steam Temperature....1005 F

Final Reheat Temperature...1005 F

Fired by.....Pulverized coal

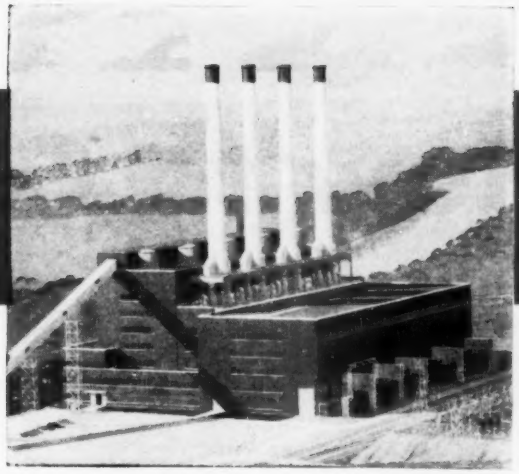
Soot Blowing....Vulcan Automatic Sequential System with air-powered, air-blowing, long retractables, rotaries and air-heater controls.

Consultants.....Sargent & Lundy

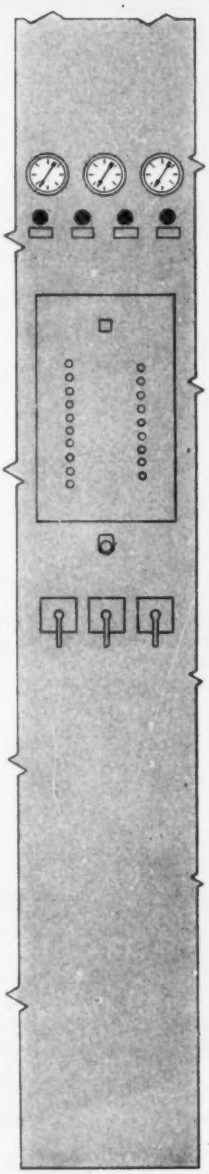


VULCAN Automatic

STATION



PUBLIC SERVICE COMPANY OF INDIANA, INC.



ADD Wabash River to the rapidly-growing list of utility stations entrusting to Vulcan the important job of boiler cleaning. Engineers are finding that the oldest name means the latest word, when it comes to soot blower design, operation and maintenance.

This Vulcan System includes long-retractables, rotary units, and air-heater controls. These types have demonstrated ability to clean effectively, at low cost and to be easily maintained. Each is designed for a specific cleaning job, and does it well.

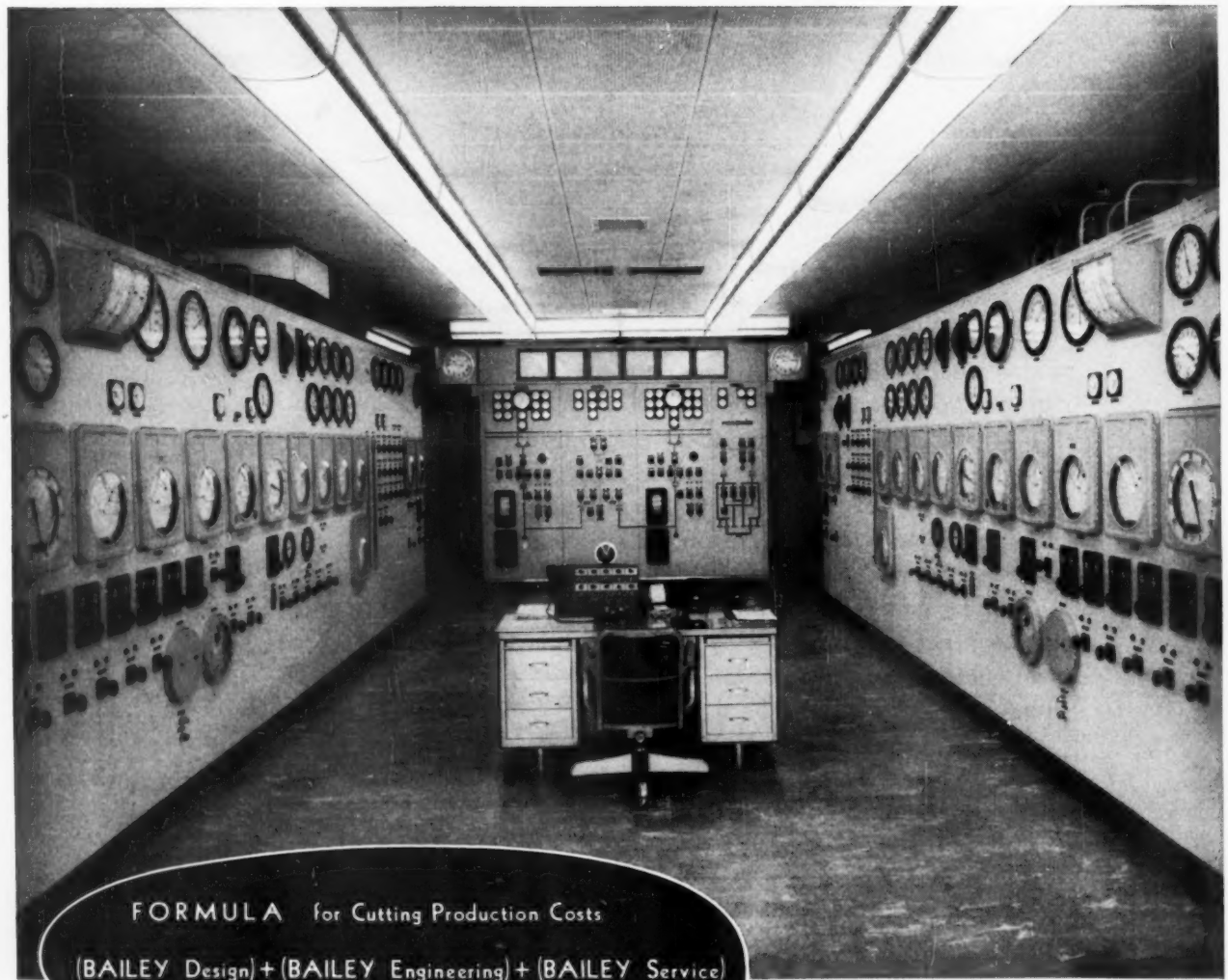
Vulcan Automatic-Sequential Control permits a flick of the wrist to set all blowers in automatic or selective sequence, or to be operated by individual push button, from a central panel.

Whether your boilers be large or small, utility or industrial, power or process—depend on Vulcan to clean them effectively at low overall cost.

COPES-VULCAN DIVISION
CONTINENTAL FOUNDRY & MACHINE COMPANY
ERIE, PENNSYLVANIA

At Wabash River Station, all soot blower instruments and controls are grouped conveniently on the operating panel for each boiler. Separate open or cubicle type panels are also available.

How to Control


FORMULA for Cutting Production Costs
(BAILEY Design) + (BAILEY Engineering) + (BAILEY Service)
= GREATER SAVINGS PER FUEL DOLLAR

Control Room at Highgrove Power Plant of California Electric Power Co., Riverside, Calif. In this "outdoor" plant Bailey Control of Combustion, Feed Water, Steam Temperature, Air Heater Temperature, and Fuel Oil Temperature, assists operators in producing low cost steam.

Units 1 & 2 are each rated at 320,000 lb per hr capacity, 850 psi, 900F. They may be fired with gas or oil.

Steam Cost

★ Close regulation of fuel and air input is vital to a strict control of your steam cost. But that's not all. You'll need control of other factors too. Your power costs can be held down only by controlling all of the important operations in your steam plant. That's where you can be sure of help from Bailey Controls. Here's why they can do the job and do it right:

1. Complete Range of Equipment—fully co-ordinated

You need never worry that a Bailey Engineer's recommendation is slanted in favor of a particular type of equipment, as might be the case if he had only a limited line to sell—or that Bailey will pass the buck for efficient control; we offer *complete* boiler control systems.

2. Engineering Service—backed by experience

No other manufacturer of instruments and controls can offer as broad an experience, based on successful installations involving all types of combustion, flow measurement, and automatic control.

3. Direct Sales-Service—conveniently located near you

Bailey Meter Company's Sales-Service Engineers are located in more industrial centers than those of any other manufacturer of boiler control systems; you get prompt, experienced service with a minimum of travel time and expense.

For close control of steam cost, more power per fuel dollar, less outage, and safer working conditions, you owe it to yourself to investigate Bailey Controls. Ask a Bailey Engineer to arrange a visit to a nearby Bailey installation. We're proud to stand on our record: "More Power To You!"

A-118-2

BAILEY METER COMPANY

1036 IVANHOE ROAD

CLEVELAND 10, OHIO

Complete Controls for Steam Plants

BAILEY METERS

Controls for

COMBUSTION
FEED WATER
TEMPERATURE
PRESSURE
LIQUID LEVEL
FEED PUMPS

This "FF" explosion cost

Famous City Hall
"Blows its Top"
A burner Flame-Failure ("FF") explosion literally blew the roof off of the famous city hall at [redacted], causing $55,000 damage and disrupting government.
Such explosions occur when burner flames fail and shut-down of fuel is not immediate. In a few seconds, still-flowing fuel forms dangerous gases which ignite explosively on hot fire brick.

COVERING THE U.S.A.—and Canada, factory-trained field engineers provide "know how" of flame failure safeguarding with FIREYE.

$55,000...

It could happen to you...

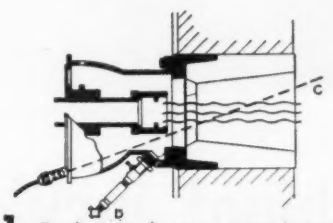
IT COULD HAPPEN, and it could be costly if your present "safeguard" responds slowly.

Today, insurance companies require automatic safeguards for commercial and industrial burners to shut off fuel in *2 to 4 seconds* after a burner Flame Failure (FF). Relatively few flame failure safeguards now in use can satisfy that requirement. Most of them actually require more than a minute for response. If your safeguard is that slow, you may be relying on no protection at all!

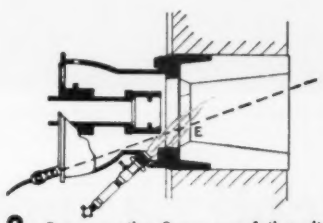
Don't delay in replacing slow, half-safe controls with the modern, fully-approved FIREYE System . . . the only *complete* and instantaneous safeguard for all types of fuels. With FIREYE, an electronic "eye" works with the speed of light when a burner flame goes out, to cut off fuel and signal operating personnel.

Thousands of installations prove FIREYE has no equal for reliability and effectiveness. Can be applied to oil, gas, coal burners "overnight" — for a negligible investment.

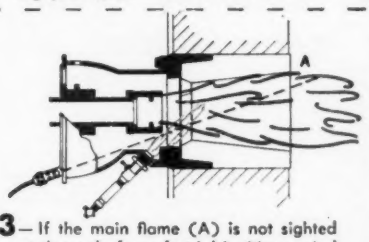
How fireye works to give you complete flame failure protection...



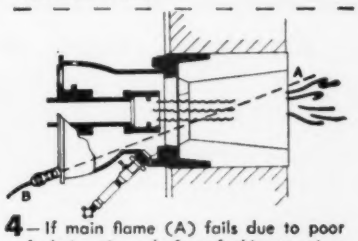
1 — To eliminate dangerous gases in combustion chamber (from leaking shut off valve during down time of burner,) FIREYE purges chamber (C) before igniting pilot (D).



2 — Because pilot flame can fail to light off due to fouled electric ignitors, no fuel, or poor fuel-air mix, FIREYE proves pilot flame (E) is proper before turning on main fuel valve.



3 — If the main flame (A) is not sighted at the end of a safe trial ignition period (due to no main fuel or poor fuel-air ratio or draft) FIREYE shuts down the burner.



4 — If main flame (A) fails due to poor fuel-air ratio or draft, or fuel interruption, FIREYE shuts down burner in 2 to 4 seconds to prevent explosion of unburned gases.

fireye®

UL FACTORY MUTUAL APPROVED

PLAY SAFE! SEND NOW!

This may be the most important book you ever read

Why take chances? Even with modern power, processing or heating equipment, the chances are 4-to-1 you do not have complete flame failure safeguards. Send for this new "primer" on flame failure explosion hazards. It tells how you can simply check the protection you now have, and what you need. Use the coupon below.

COMBUSTION CONTROL CORP.,
Dept. PB 8, 718 Beacon St., Boston, Mass.
Send me your free booklet
"Guarding Your Properties Against Flame Failure Explosions".

Name..... **(Title)**.....

Firm.....

Address.....

ONLY UNDER DIRECT FLAME, will GE's new self-extinguishing insulation for metal-clad switchgear char—as demonstrated in this picture with flame of blow-torch applied directly to the new laminated sheet-type insulation.

GE's "self-extinguishing" insulation gives

New sheet-type material with exclusive, flame-retardant feature localizes damage that may occur under abnormal conditions

The equivalent of a "built-in fire extinguisher"—a flame-retardant insulation for switchgear, marks the most recent General Electric development for even safer, more dependable metal-clad switchgear—industry's standard for 2400- to 13,800-volt circuits.

In introducing this flame-retardant insulation—which was perfected by Nicholas F. Arone, engineer in its Switchgear Department in Philadelphia—G.E. has gone far to minimize all potential fire hazards in switchgear.

All good insulating material has three standard properties: high mechanical strength, high dielectric strength, and a non-hygroscopic quality. To this group, G.E. is the first to add an important fourth property: a self-extinguishing characteristic that *refuses to sustain combustion.*

The laminated insulation sheet will burn and char—but *only* if an outside source of flame remains in contact with the sheet itself. Once the source is removed, polyvinylchlorides "smother" the flame in less than a minute—localize damage—and permit quick access to compartments for inspection and maintenance.

In bus and cable supports, in insulating barriers between compartments, in box barriers for arc chutes—throughout vital spots of metal-clad, GE's new flame-retardant insulation works for greater protection under *all* conditions—without extra cost to you.

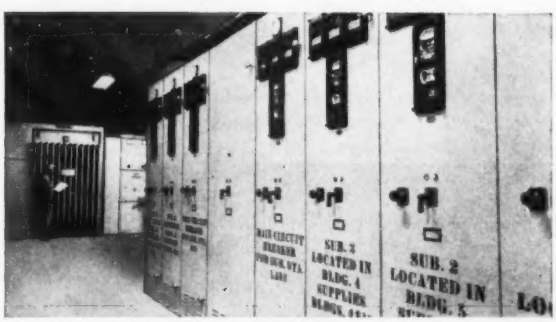
For information on improved Metal-Clad Switchgear, with new, flame-retardant insulation, call your nearest G-E sales representative, or write to General Electric Company, Schenectady 5, N. Y. 874-3

G. E. BURENS, *general manager, Switchgear and Control Division, presents Coffin Award to N. F. Arone for development of outstanding new insulation. Coffin Award is General Electric's highest employee honor.*

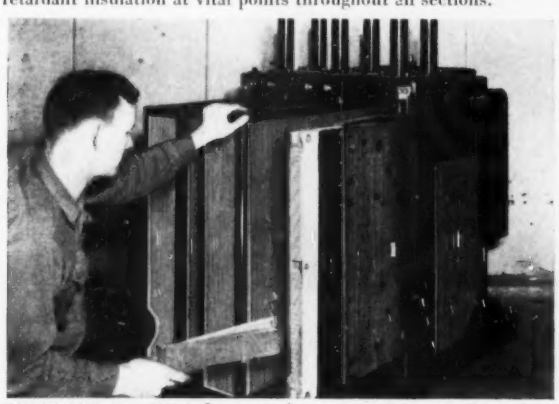
GENERAL ELECTRIC

WITH FLAME REMOVED, the flame-retardant insulation refuses to sustain combustion—and extinguishes itself in less than 60 seconds. Polyvinyl-chlorides in the laminated sheet "smother" the flame, permitting ready access to compartments for inspection and maintenance.

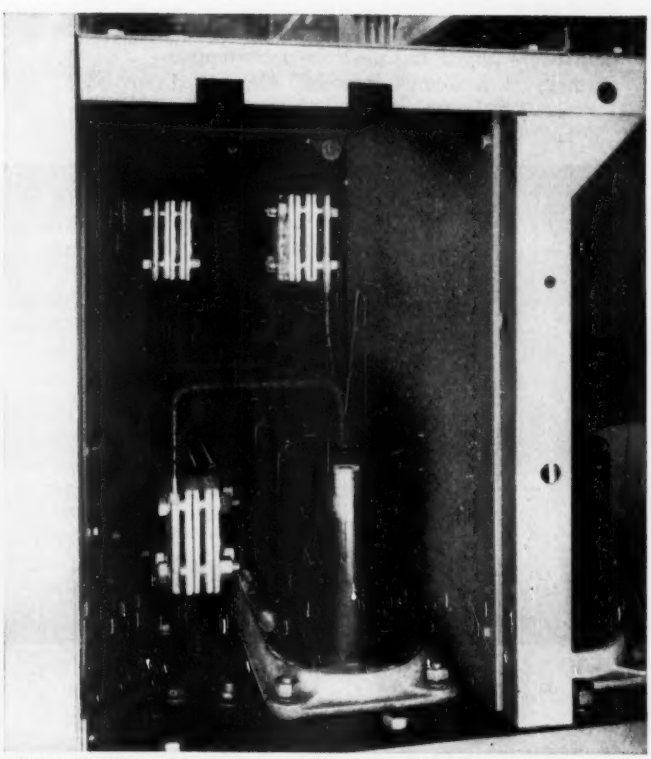
added protection to metal-clad switchgear



THIS METAL-CLAD SWITCHGEAR lineup features GE's new flame-retardant insulation at vital points throughout all sections.



INSULATING BARRIERS for arc chutes are flame-retardant, non-hygroscopic, possess high mechanical and dielectric strength.



COMPARTMENTIZED SECTIONS, in addition to self-extinguishing insulation as shown in this bus section, limit damage from abnormal conditions.

Harnessing heat for all industry

HEAT is one of man's most useful servants. With it, he can separate gasoline from crude oil . . . cook food . . . generate electricity . . . refine steel from raw ore and roll it into mile-long sheets. But to do these and countless other jobs, heat must be applied in the correct amounts . . . to obtain critical temperature values.

Forward-looking research and production men realized some years ago that "rule of thumb" was entirely inadequate for replacing complex processes. They needed facts obtainable only from automatic measurement . . . performance possible only through automatic control.

Honeywell has consistently led the way toward new and better temperature instrumentation. Continuing research has developed sensing elements which cover the full temperature spectrum . . . instruments which provide the desired accuracy . . . and automatic controls which can regulate any production process.

instruments

The complete Honeywell family offers a broad choice of characteristics to suit individual applications. *ElectroniK* indicators, circular chart and strip chart recorders and controllers afford the peak in performance through "Continuous Balance" high-speed electronic measurement. *Pyr-O-Vane* millivoltmeter instruments fit many processes which need accurate indication and control. Brown Thermometers are economical instruments for recording and controlling moderate temperatures.

controls

With *Pyr-O-Vane* instruments you can have electric control of either the two-position, three-position or time-proportioning types.

With Thermometers, you may choose from electric two-position, pneumatic on-off or proportioning control, and cam-operated program control.

With *ElectroniK* instruments, your selection covers practically any form of electric or pneumatic control, including the most advanced types suitable for complex processes, and the most flexible program controls.

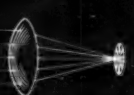
Watch 270 plant *with the*

sensing elements

thermocouples

the most versatile of temperature elements, are supplied for ranges from −300 to +2800° F.

Radiamatic



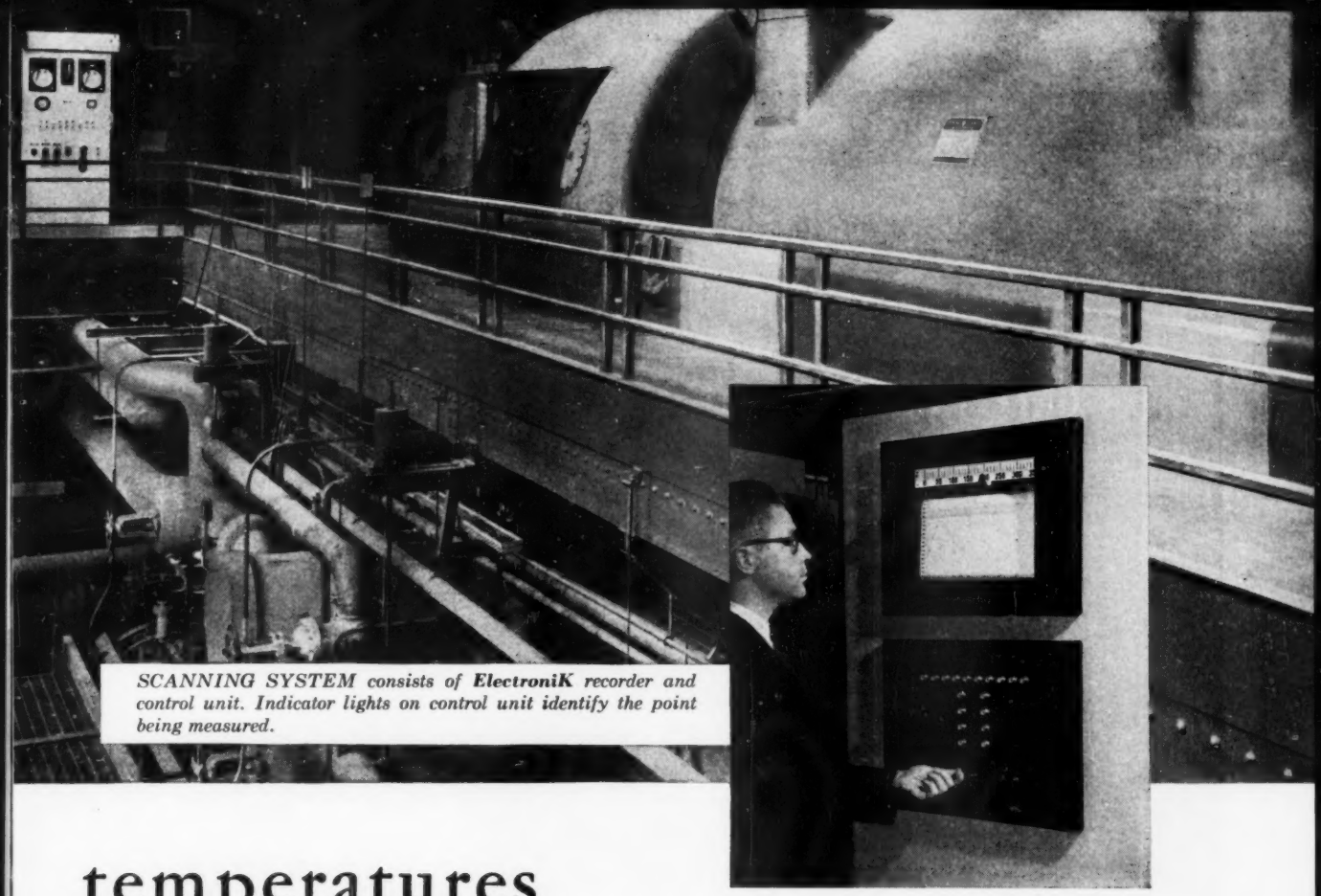
(radiation-type) elements are applicable to direct measurement of work temperature . . . to moving objects . . . to extremely high ranges and other jobs impossible for any other element.

resistance thermometers

are recommended for highest accuracy from sub-zero to 300° F. and for narrow spans.

thermometer bulbs

rugged, sensitive elements for moderate temperatures.



SCANNING SYSTEM consists of ***ElectroniK*** *recorder and control unit. Indicator lights on control unit identify the point being measured.*

temperatures *ElectroniK* scanner

IT'S EASY and economical to keep constant watch over temperatures of potential trouble spots throughout the plant, when you have an *ElectroniK* Scanning System. From a central point, you can monitor temperatures of bearings, hydraulic couplings, boiler tubes, cooling oil lines . . . at surprisingly low cost per point.

This instrument can concentrate data from as many as 270 different locations. It scans through successive thermocouple points at a rate as fast as one second per point . . . re-checking each point at approximately four-minute intervals.

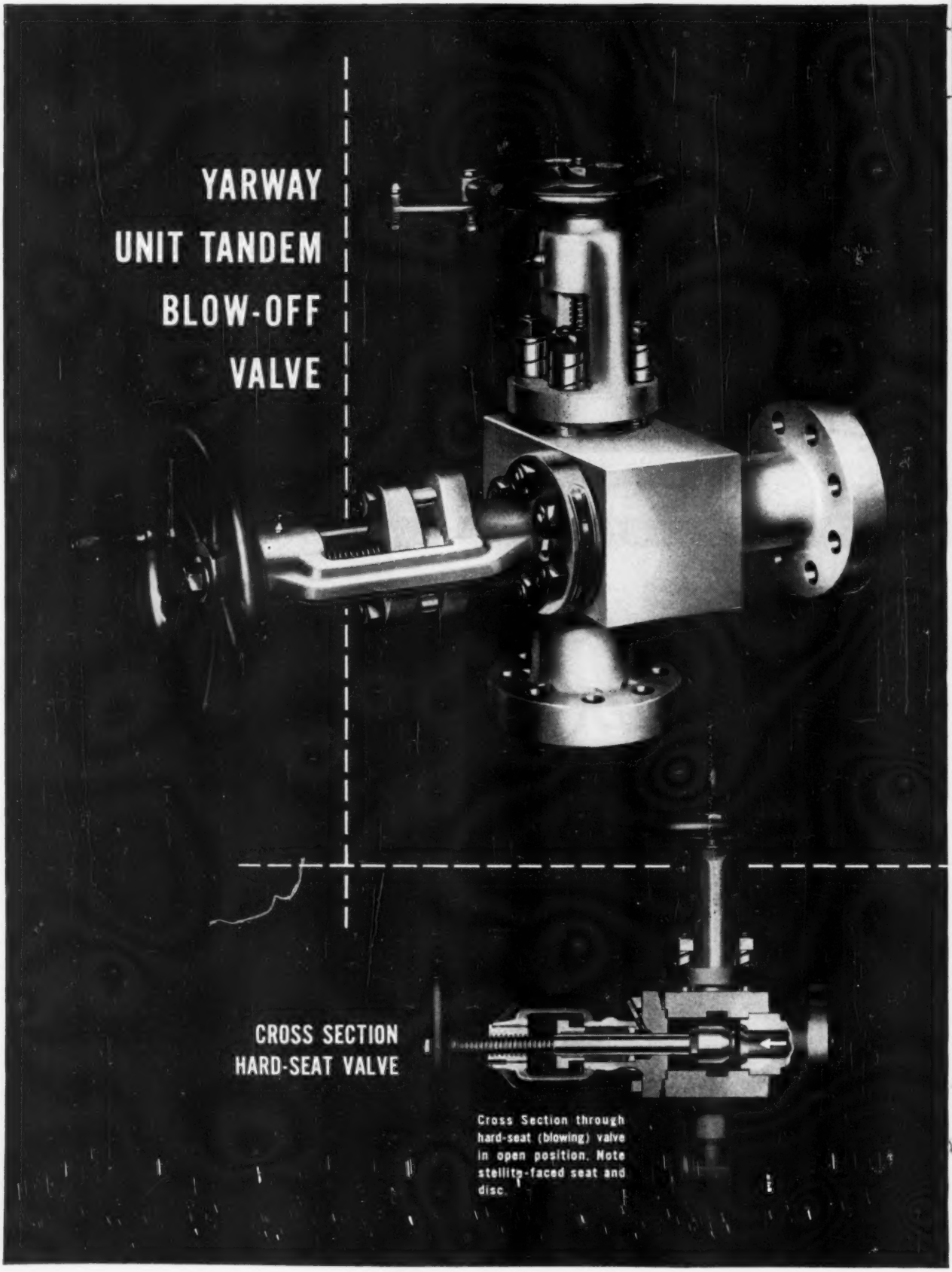
At the operator's choice, it can perform these various functions: simple scanning without recording, continuous recording of all 270 points, selective recording, recording of points which depart from specified limits, and operation of annunciator contacts when any temperature exceeds a pre-set point. The chart moves only when the instrument is actually recording. Separate temperature limits can be set for each bank of 9 thermocouples.

Your local Honeywell engineering representative will be glad to discuss how this instrument can help you protect plant equipment economically. Call him today . . . he is as near as your phone.

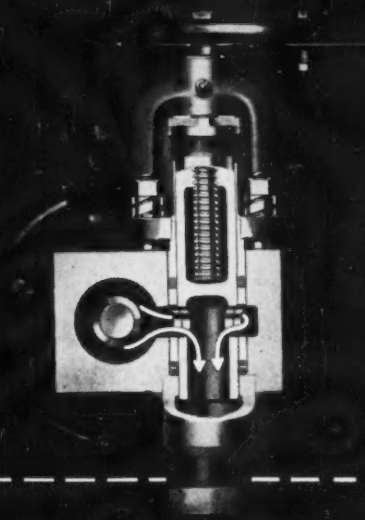
MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4490 Wayne Ave., Philadelphia 44, Penna.

● **REFERENCE DATA: Write for Data Sheet No. 10.0-9, "*ElectroniK* Scanning System," and Catalog 90-2, "Supervisory Instruments for Power Generation."**

MINNEAPOLIS **Honeywell**
BROWN INSTRUMENTS
First in Controls


YARWAY
UNIT TANDEM
BLOW-OFF
VALVE
CROSS SECTION
HARD-SEAT VALVE
Cross Section through hard-seat (blowing) valve in open position. Note stellite-faced seat and disc.

CROSS SECTION
SEATLESS VALVE



Cross Section through seatless (sealing) valve in open position. (On pressures over 1500 psi two hard seat valves are recommended.)

RUGGEDNESS

... WHERE YOU NEED IT

A one-piece forged steel block serves as the common body for both valves in Yarway Unit Tandem Blow-Off Valves.

You get rugged strength where you need it ... added protection for your high pressure boilers.

Whether in times of emergency, normal blowdown service, or acid washing, this high safety factor is a source of satisfaction to boiler plant operators.

Yarway Unit Tandems combine all advancements of modern metallurgy with experienced design and skilled workmanship. The result—DEPENDABLE PROTECTION.

POSITIVE ACTION

... WHEN YOU NEED IT

When putting high pressure boilers on the line, or in times of emergency, you need positive action at the blow-off valves.

With Yarways you have it.

Both the hard seat-seatless combinations and the hard seat-hard seat combinations provide positive opening and closing with drop-tight shut-off. Open yokes permit visual indication of the disc position in the hard seat valve and of the plunger in the seatless valve.

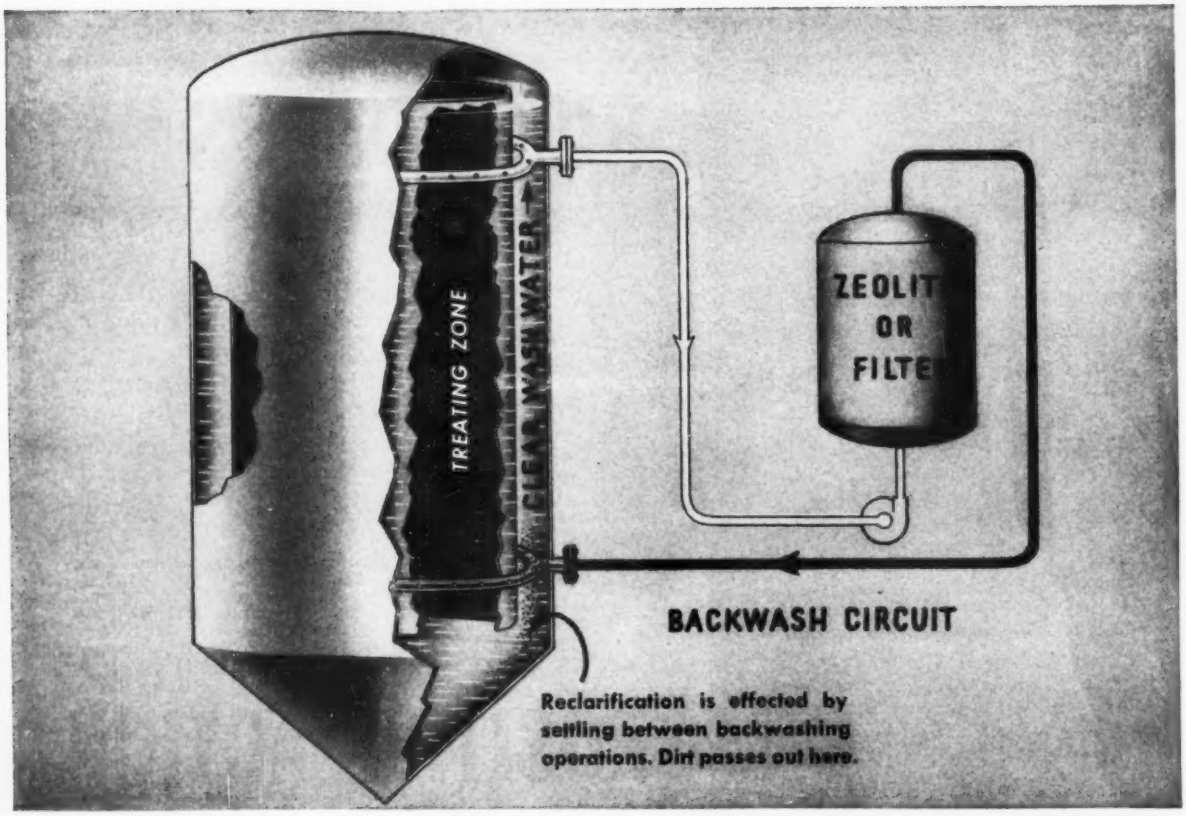
These are some of the reasons why *more than 4 out of every 5 high pressure plants in the United States are Yarway-equipped . . . and* among boiler plants of all pressures, *more than 16,000 are Yarway-equipped*

Write for your free copy of Yarway Blow-Off Valve Bulletin B-425 (pressures to 400 psi) or Bulletin B-433 (pressures to 2500 psi).

YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.

YARWAY

blow-off valves



BACKWASH FLOW CIRCUIT IN WORTHINGTON HOT-PROCESS SYSTEM shows how *independent* built-in, annular wash-water compartment* provides clean, hot, chemically inert water for backwashing and reclaims it without affecting operating velocities in treating zone, or subjecting hot zeolite to temperature changes. Backwashing is accomplished by recirculation of the clarified wash water.

*Reg. U.S. Pat. Off. 2,263,398

You can't wash clean with dirty water!

How Worthington Hot-Process Water-treating systems backwash with CLEAN, hot, chemically inert water

When you're considering hot-process water-treating systems with hot zeolite, filters, or both, *don't overlook backwashing facilities.*

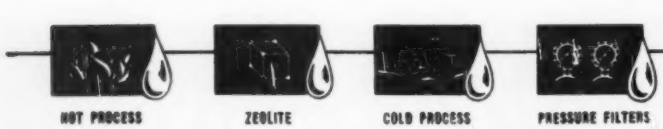
They must be well designed, or the system cannot give smooth, efficient, trouble-free performance. Worthington engineers recognized this fact when they designed their first hot-process system. Today, every Worthington standard Hot-Z or conventional system provides exclusive *independent* facilities for backwashing zeolite or filters with clean, hot, chemically inert water without disturbing the normal flow through the reaction bank.

Worthington water-treating specialists don't believe you can wash clean with dirty water.

This unique backwashing provision is just one of many Worthington patented features, but it alone will more than justify your selection of a Worthington system for hot-processing boiler feedwater in your plant.

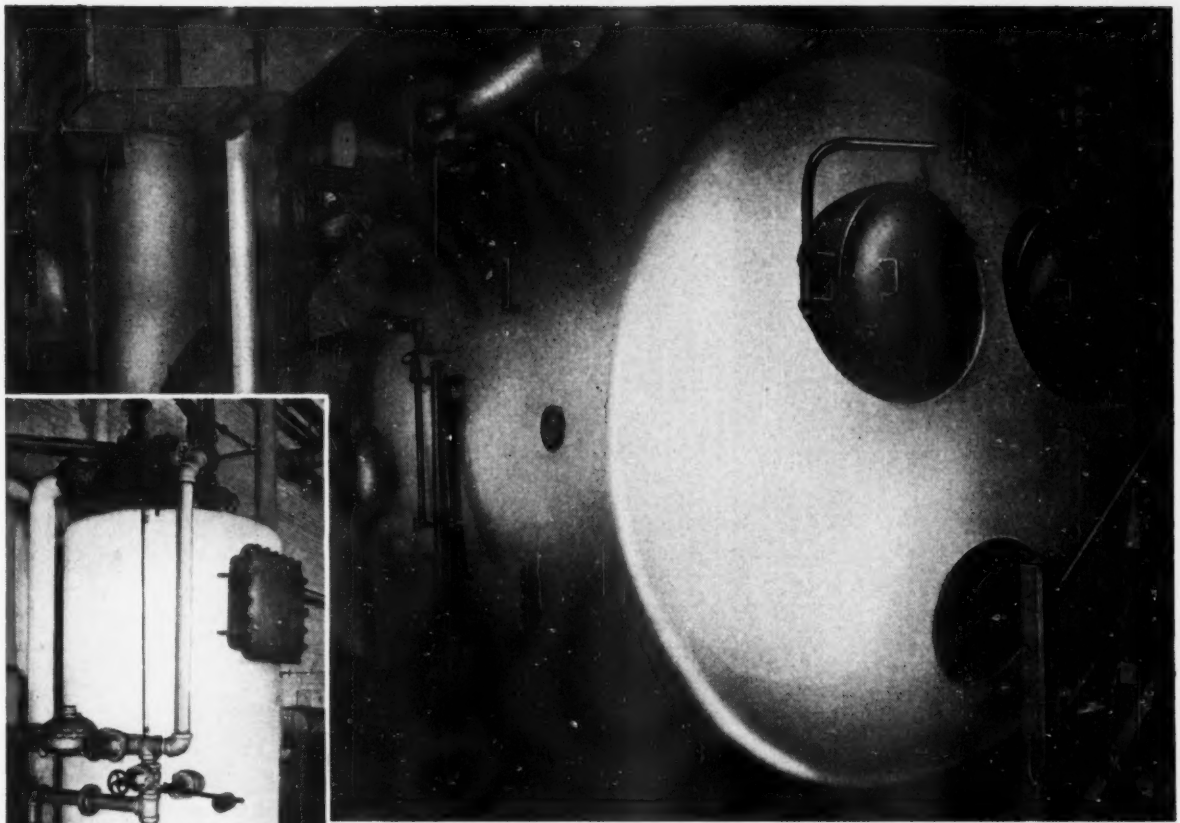
If you have a problem, whether it involves filtration, precipitation, or zeolite treatment, Worthington specialists will be happy to study your water-treating problem and recommend the proper system. Just write, stating service conditions in detail, to Worthington Corporation, Water Treating Division, Harrison, N. J.

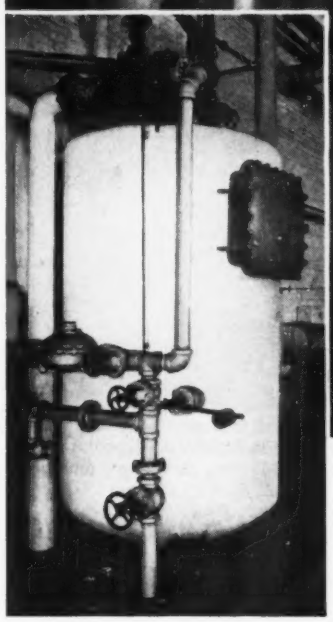
J.3.1



Worthington Makes More of the Equipment for ALL Types of Water Conditioning Systems

WORTHINGTON
Water Conditioning





A Big Help

on small—as well as big—deaeration jobs

Small deaerators are big business at Worthington! That's why the plant with small-capacity requirements will benefit by getting acquainted with the complete range of Worthington deaerating equipment.

Worthington Gives You All Types, All Sizes

Worthington deaerating heaters and deaerators are built in sizes to handle from a few thousand pounds an hour to over a million. They are tailor-made to fit the particular requirements of each job. Special designs are available for operation with scale-forming water.

Both tray and steam-jet types are made—with external surface-type vent condensers or internal direct-contact vent condensing. They can be furnished for any practical operating pressure—constant or variable—or for vacuum operation.

With a complete range of sizes and types at their fingertips, Worthington engineers can competently recommend the design best suited to *your* requirements.

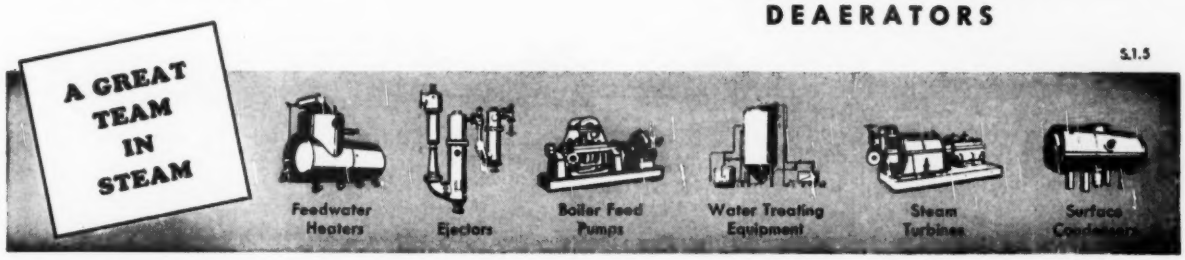
Remember, too, Worthington designs are backed by over 50 years experience in the design and manufacture of direct contact feedwater heaters and over 100 years experience in hydraulic machinery.

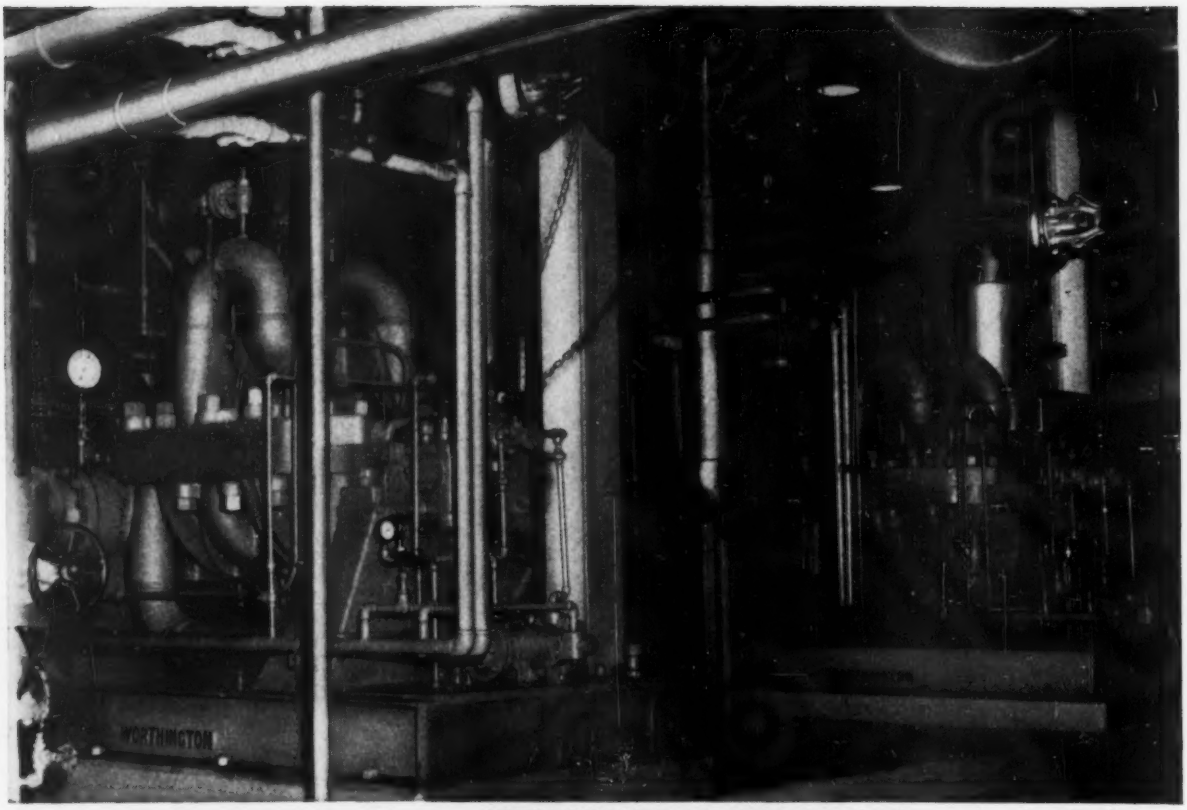
Send your water treating problem to Worthington Corporation, Steam Power Division, Harrison, N. J.

WORTHINGTON

DEAERATORS

S-1-5





THIRTY WORTHINGTON BOILER FEED PUMPS have been purchased by the Southwestern Public Service Company of Amarillo, Texas. The two boiler feed pumps above, installed at Southwestern's new Plant X, deliver 1165 gpm, at 1125 psi total head.

Worthington helps bring more power to the Southwest

30 Worthington boiler feed pumps installed by Southwestern Public Service since 1945

Plant X, ten miles north of Amherst, Texas, is the newest and largest of the Southwestern Public Service Company's eleven generating stations. Since September, 1945, Southwestern Public Service has been expanding, building new stations to meet the Southwest's increasing power needs.

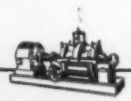
Worthington has played an important part in this expansion. During the past eight years, thirty Worthington boiler feed pumps have gone into Southwestern Public Service power plants. In Plant X alone, Worthington has supplied, in addition to the boiler feed pumps, heater drain pumps, water softeners, sump pumps, air compressors, and the open feed-water heater.

Power engineers everywhere have found that Worthington has kept pace with the increase in capacity and pressure of steam generating units and is prepared to furnish boiler feed pumps for any modern power plant requirements.

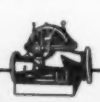
We'd like to hear about your own pumping problems. Get in touch with your nearest Worthington district office, or write directly to Worthington Corporation, Centrifugal Pump Division, Section C.3.5, Harrison, N. J.

C.3.5

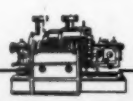
For Boiler Feed Service. Capacities to 1,500 GPM; Heads to 1,000 feet.



For Hotwell, Condensate, Chilled Water Service. Capacities to 1,400 GPM; Heads to 650 feet.



For Water Works, Circulation, Drainage, General Service. Capacities to 135,000 GPM; Heads to 400 feet.

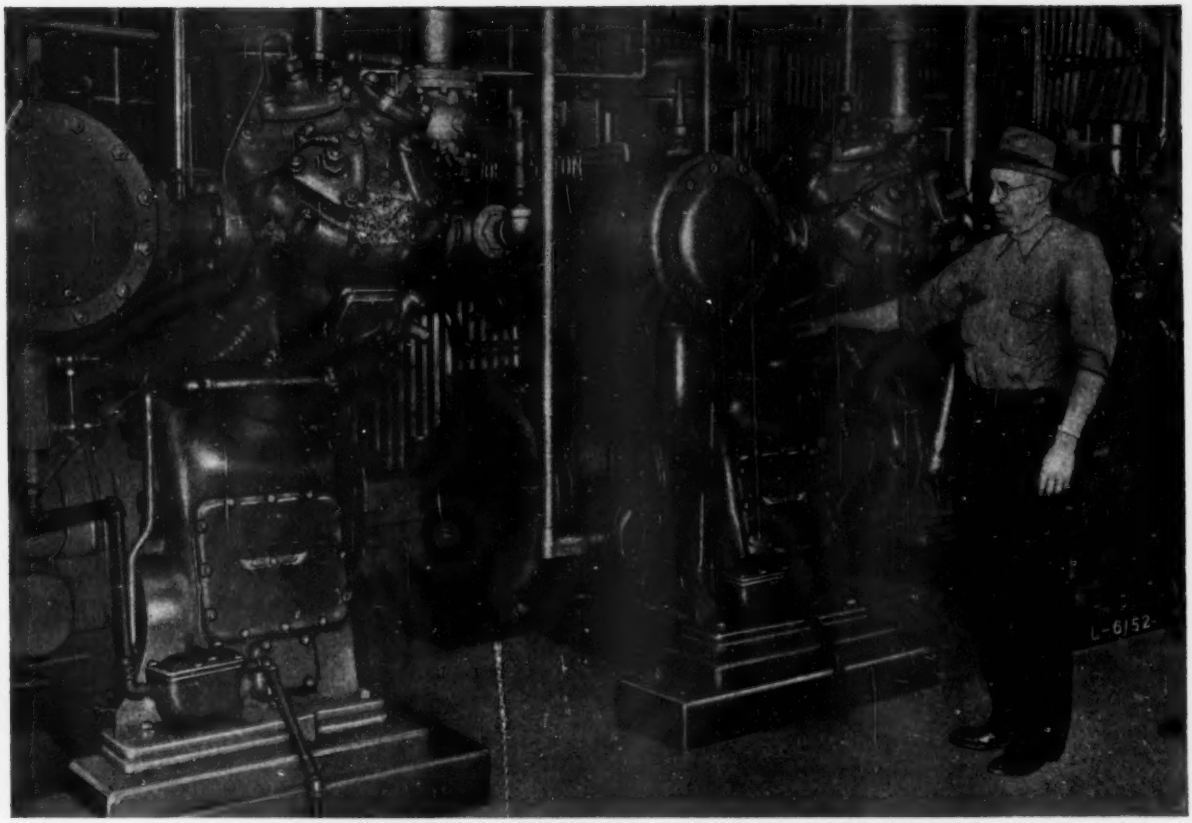


For Boiler Feed Service. Capacities to 3,000 GPM; Heads to 7,000 feet.

WORTHINGTON

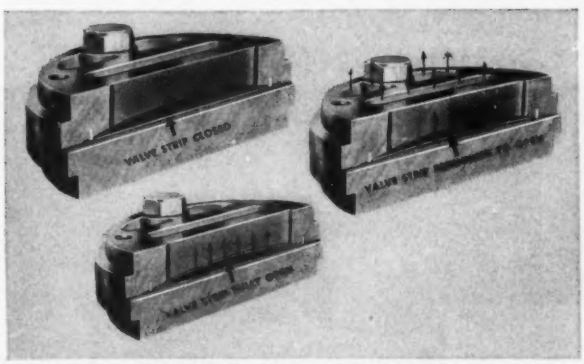
Centrifugal Pumps

The World's Broadest Line Assures You the Right Pump for Every Job



WORTHINGTON TYPE YC-2 COMPRESSORS supplying compressed air for the Coos Bay, Oregon plant of the Evans Products Company. These units are supplied with high-efficiency Three Step Variable Capacity Control.

Coos Bay plywood plant smooths out vibration problem



THE QUIET-OPERATING WORTHINGTON FEATHER* VALVE is made up of a series of thin flexible strips of ribbon steel, held in position over rectangular openings, by curved milled guards. The valve strips lift and flex uniformly against the curved guards. In addition to quiet operation, the absence of impact results in long valve life and low maintenance costs.

Heavy vibration had caused tube trouble in the steam generating equipment at the Coos Bay, Oregon, plant of the Evans Products Company.

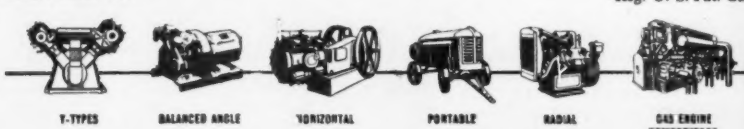
When it came time to install new compressors in this critical area, plant engineers solved their problem by choosing two quiet-running Worthington YC-2's.

After three years, the low-vibration performance of the two Worthingtons was so satisfactory that another YC-2 was ordered and installed this year—making an all-Worthington compressor installation.

Contributing to the smooth operation of Worthington compressors are the exclusive Worthington Feather* valves—the lightest, simplest and most efficient valves ever developed for compressor operation. Valve seating is always quiet and positive.

Write us about your compressor problem. Worthington Corporation, Compressor Division, Section K.3.1, Buffalo, New York. K.3.1

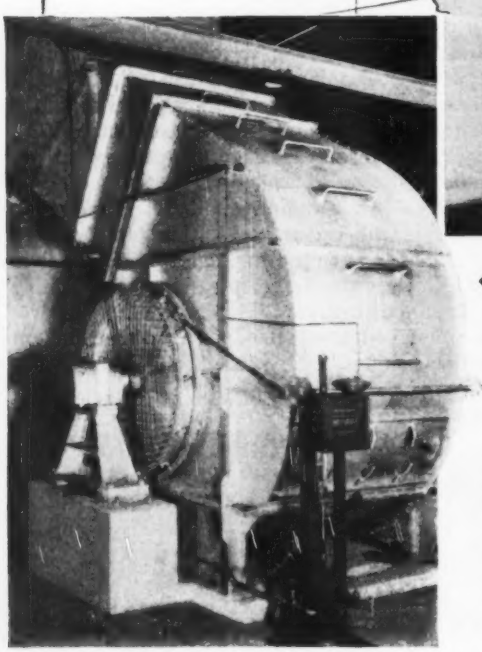
*Reg. U. S. Pat. Off.

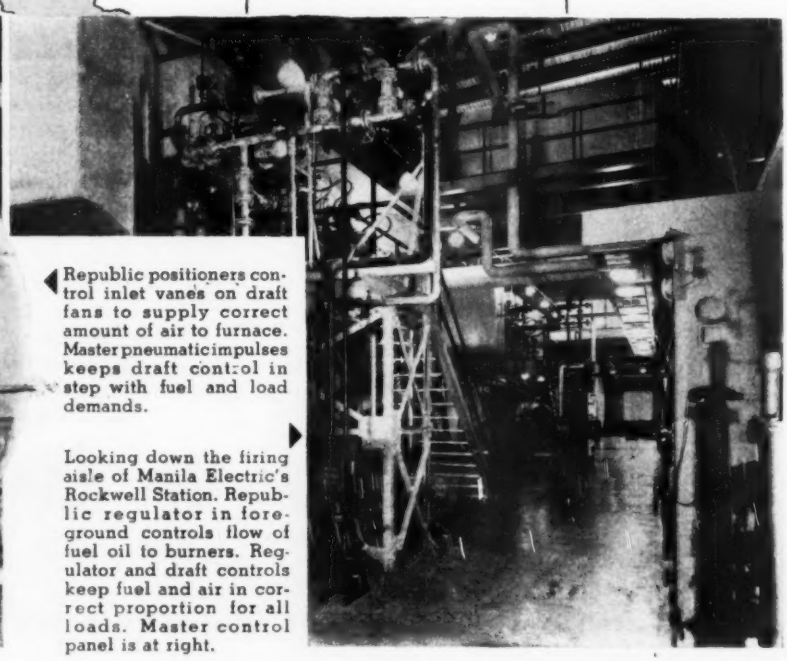


ONLY WORTHINGTON COMPRESSORS
GIVE YOU FEATHER VALVE PERFORMANCE

IN THE PHILIPPINES

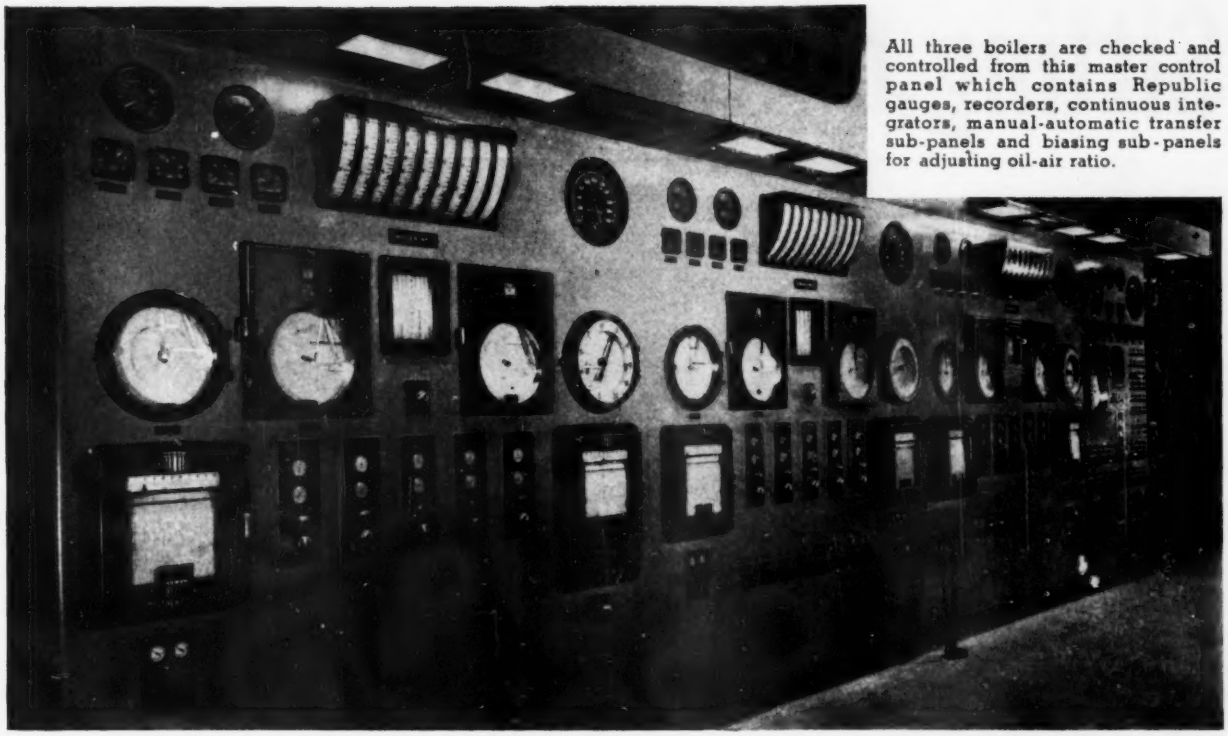
MANILA ELECTRIC Rebuilds . . . .





Republic positioners control inlet vanes on draft fans to supply correct amount of air to furnace. Master pneumatic impulses keeps draft control in step with fuel and load demands.

Looking down the firing aisle of Manila Electric's Rockwell Station. Republic regulator in foreground controls flow of fuel oil to burners. Regulator and draft controls keep fuel and air in correct proportion for all loads. Master control panel is at right.



All three boilers are checked and controlled from this master control panel which contains Republic gauges, recorders, continuous integrators, manual-automatic transfer sub-panels and biasing sub-panels for adjusting oil-air ratio.

installs **REPUBLIC** *Automatic*

COMBUSTION CONTROLS to get maximum combustion efficiency

1945. Manila is a shambles. Rebuilding of pre-war power equipment starts. But power demands skyrocket. It's necessary to bring in a floating 30,000 kw power station to meet the emergency. Electrical demand grows until it is even more than pre-war power facilities can handle. Distribution transformers must be worked until the insulating oil boils; sub-station transformers must be constantly cooled with a water spray; wires turn cherry red because the overloads are so great.

That was the Manila power situation after the war. Now, Manila Electric Company, who had to meet this demand, is over the "hump." One big reason is its modern new power station which is capable of generating 50,000 kw. Designed by Gilbert Associates, Inc., it contains three oil-fired boilers, each rated at 250,000 lbs. per hr. at 875 psig and 910° F. To maintain the operation of these boilers at maximum efficiency under all load conditions, Republic Automatic Combustion Controls have been installed. Pressure reducing valves and controls plus feedwater pump controls were also furnished by Republic.

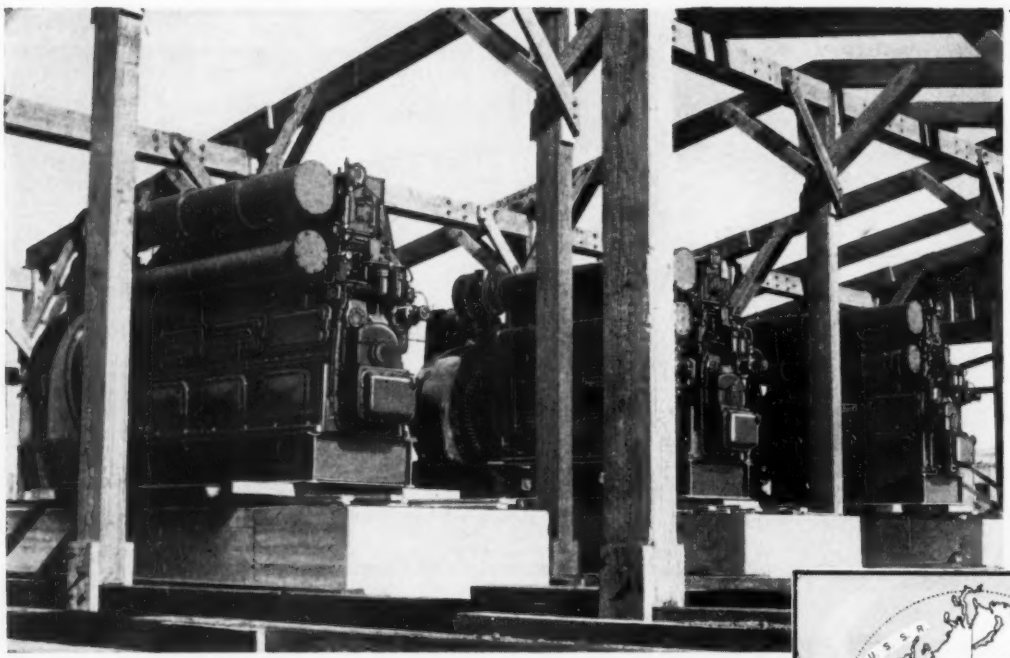
This is but one example of power stations all over the world that are equipped with Republic Combustion Controls. Recent over-seas installations include stations in Italy, Greece, Chile, India and Australia.

Wherever the station, whatever the fuel, draft arrangements or load characteristic, Republic Combustion Controls can operate boilers to hold fuel and air in the correct amounts and proportion for maximum combustion efficiency.

Get the details in Data Book S-21 or contact your nearby Republic field engineer.

REPUBLIC FLOW METERS CO. ● 2240 DIVERSEY PARKWAY • CHICAGO 47, ILLINOIS

Sitting on top of the world



Over 30 Ingersoll-Rand Diesel Engines generate electric power for north polar air base . . .

Here at Thule – civilization's northernmost outpost, only 900 miles from the pole – the fierce arctic winter is 8 months long, with temperatures of 50 below zero and hurricane winds up to 150 miles an hour! At an isolated outpost like this, the traditional *dependability* of Ingersoll-Rand diesel engines is a tremendous asset.

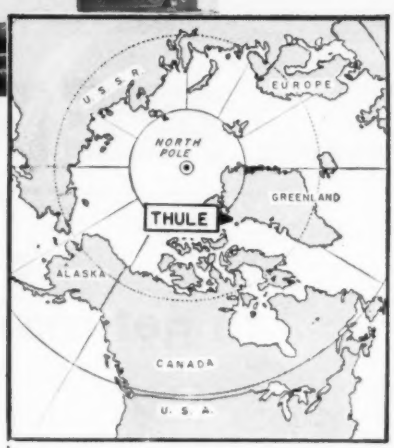
The engines generate electric power for the new 480 acre American air base at Thule. Three of them are shown above during construction of one of the power plants.

The engines were shipped completely assembled. Their *compact design* and low weight-to-horsepower ratio simplified handling and installation under very difficult conditions. Low fuel consumption, too, is an important consideration for a diesel engine installation such as at Thule. It's also one of the reasons why I-R diesels are repeatedly selected when *economy of operation* and *heavy-duty service* must be combined.

Ask your nearest Ingersoll-Rand engineer to tell you about the many other important advantages of I-R heavy-duty 4-cycle diesels – built in sizes from 200 to 900 hp.

946-7

Ingersoll-Rand
11 BROADWAY, NEW YORK 4, N. Y.

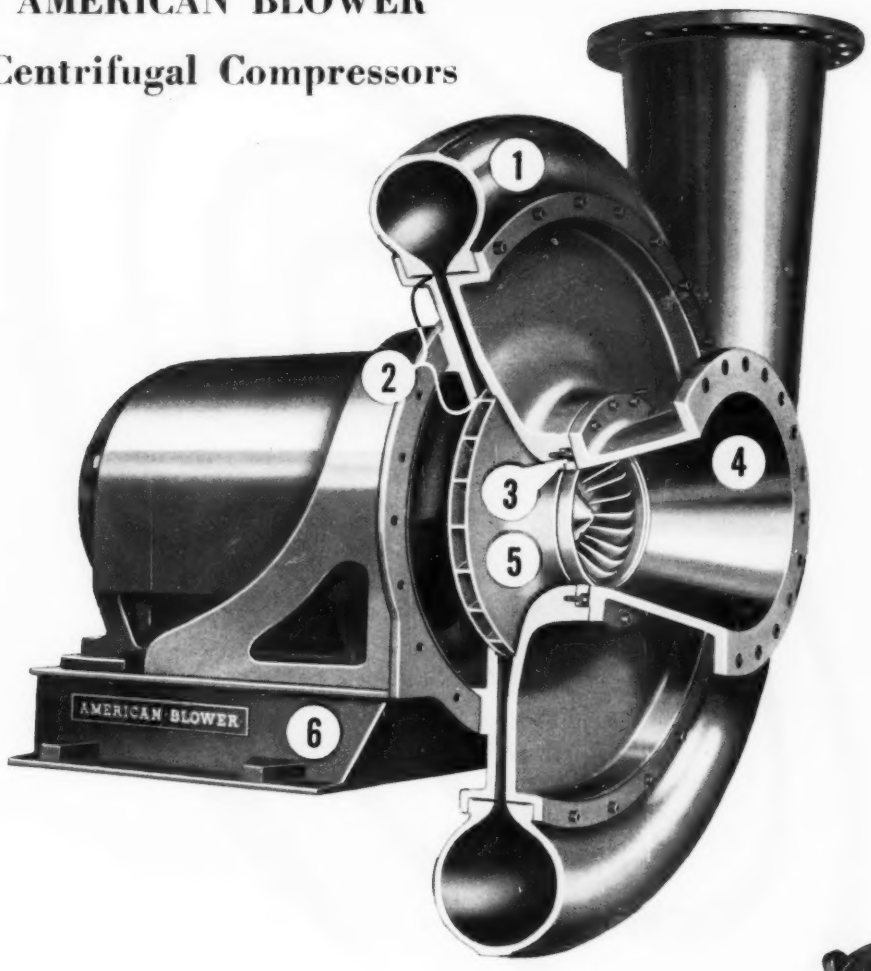


Construction of the diesel power plants at Thule was an ingenious solution to one tough problem called "perma-frost", a condition in which the earth a few feet below the surface is frozen to rock-like hardness. Ordinary building foundations were ruled out. The diesel-generator units were bolted to thick concrete slabs resting on piles set into the frozen ground. Buildings were constructed around them with floors laid on timbers above the ground. The underfloor air space insulates the building from the earth – and heavy concrete weights anchor the structures against the strong winds.

COMPRESSORS • ROCK DRILLS • AIR TOOLS • TURBO BLOWERS • CONDENSERS • CENTRIFUGAL PUMPS • DIESEL AND GAS ENGINES

AMERICAN BLOWER

Centrifugal Compressors



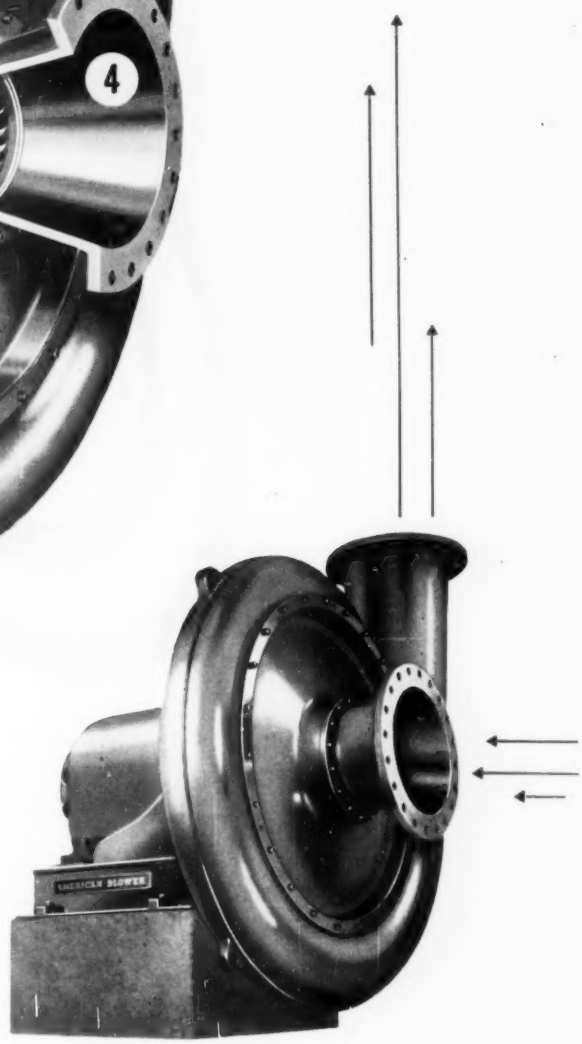
American Blower Centrifugal Compressors offer outstanding design features which improve efficiency, facilitate installation and minimize maintenance.

In the cutaway view, above: (1) Improved, scroll-shaped, casing design increases compressor efficiency. (2) Unobstructed diffuser passage efficiently converts velocity energy into pressure. (3) Annulus packing, having machined labyrinths, minimizes recirculation of gas around the impeller inlet. (4) Removable inlet nozzle. (5) Aerodynamic design of impeller blades results in high efficiencies. (6) Welded-steel baseplate "stress relieved" prior to machining, assuring maintained alignment.

For data, ask our nearest branch office.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary corporation



American Blower Single Stage Centrifugal Compressors are available in sizes 30 to 600 h.p., and pressures 1¼ to 3¾ lbs.

AMERICAN BLOWER

YOUR BEST BUY IN AIR HANDLING EQUIPMENT

Serving home and industry

AMERICAN-STANDARD · AMERICAN BLOWER · CHURCH SEATS & WALL TILE · DETROIT CONTROLS · KEWANEE BOILERS · ROSS EXCHANGERS

For information concerning American Blower or Canadian Sirocco power plant equipment, please call the nearest Branch Office or Sales Representative. They are strategically located for your convenience in the cities listed below.

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Denver, Colorado
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DETROIT 32, MICHIGAN

CANADIAN SIROCCO COMPANY, LTD.
WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary corporation

Serving home and industry

AMERICAN-STANDARD · AMERICAN BLOWER · CHURCH SEATS & WALL TILE · DETROIT CONTROLS · KEWANEE BOILERS · ROSS EXCHANGERS

This cagelike contraption spins like a top all day long, breaking up a special kind of rock used in making glass.

From 2-foot rocks to glass

Huge rocks, sometimes 18 to 24 inches thick, are loaded into this breaker and spun around till they're broken into little pieces. But just picture the jar every time another load of boulders is dumped in, and the shock to the V belts used to turn the breaker. The jolting action caused ordinary belts to wear out too soon—usually after only two months' work. To find out how this problem was solved — see the following pages.

Two-foot rocks (continued)

The belts that turn the big rock breaker shown on preceding page must be extra strong to stand hard pulls and shock loads.

The plant owner solved the problem described on the preceding page when he had a set of B. F. Goodrich grommet V belts installed. Because they're built to take shocks and heavy loads, the grommet belts are lasting 30% longer than any belt ever used before, and they also do a better job of running the breaker. Here are the basic reasons BFG grommet belts outlast and outperform ordinary V belts:

Strongest V belt made

All the load-carrying cords in grommet belts are concentrated in twin grommets. These grommets are cord loops made like giant twisted cables except

that they're endless. Since there are no center cords, the grommet belt is more flexible, and so can "give" temporarily and absorb shock loads. As a result, grommet belts last 20 to 50% longer, depending on the service. (The more severe the service, the greater the increase over ordinary belts.)

No weak spots

The section where cords overlap is the weak spot in ordinary belts. That's where 80% of V belt failures occur. But in grommet V belts this cause of belt failure has been eliminated. The grommets are endless. There are no splices or overlaps—no weak spots to cause premature belt failure.

⅓ more gripping power

Grommet V belts have more rubber in relation to belt size. Without any stiff overlap, they're more flexible, grip sheaves better. Size for size, grommet belts give ⅓ more gripping power with less slip, pull heavier loads with a higher safety factor. And because there is less slip, there is also less surface wear.

Less stretch

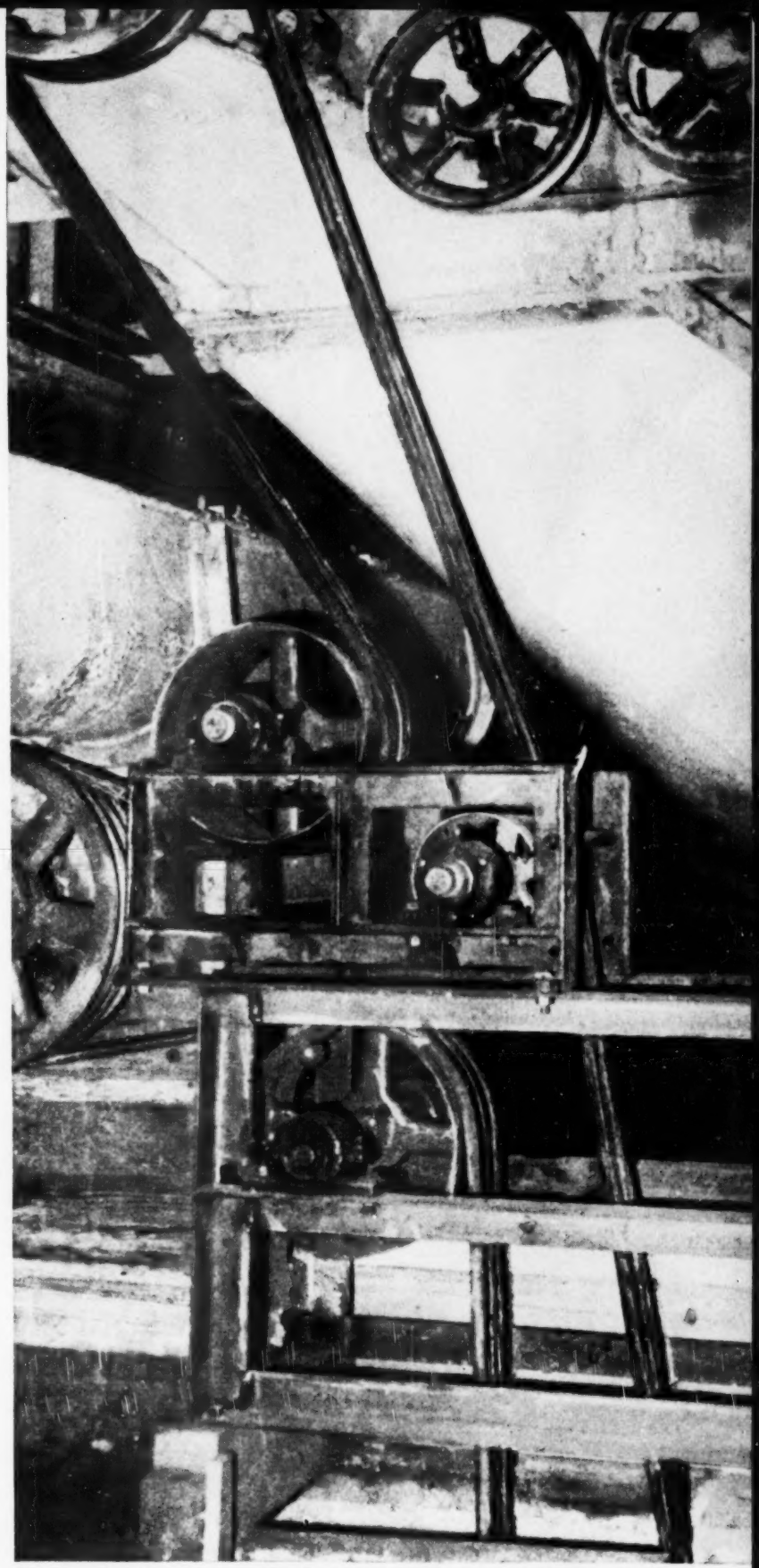
In ordinary belts under tension, the center cords loaf, the outer cords overwork because tension is greater near the driving faces. Grommet belts, with no center cords, have much more strength and less stretch. Grommet belts stretch, on an average, only about ⅓ as much as ordinary belts.

Save 3 ways

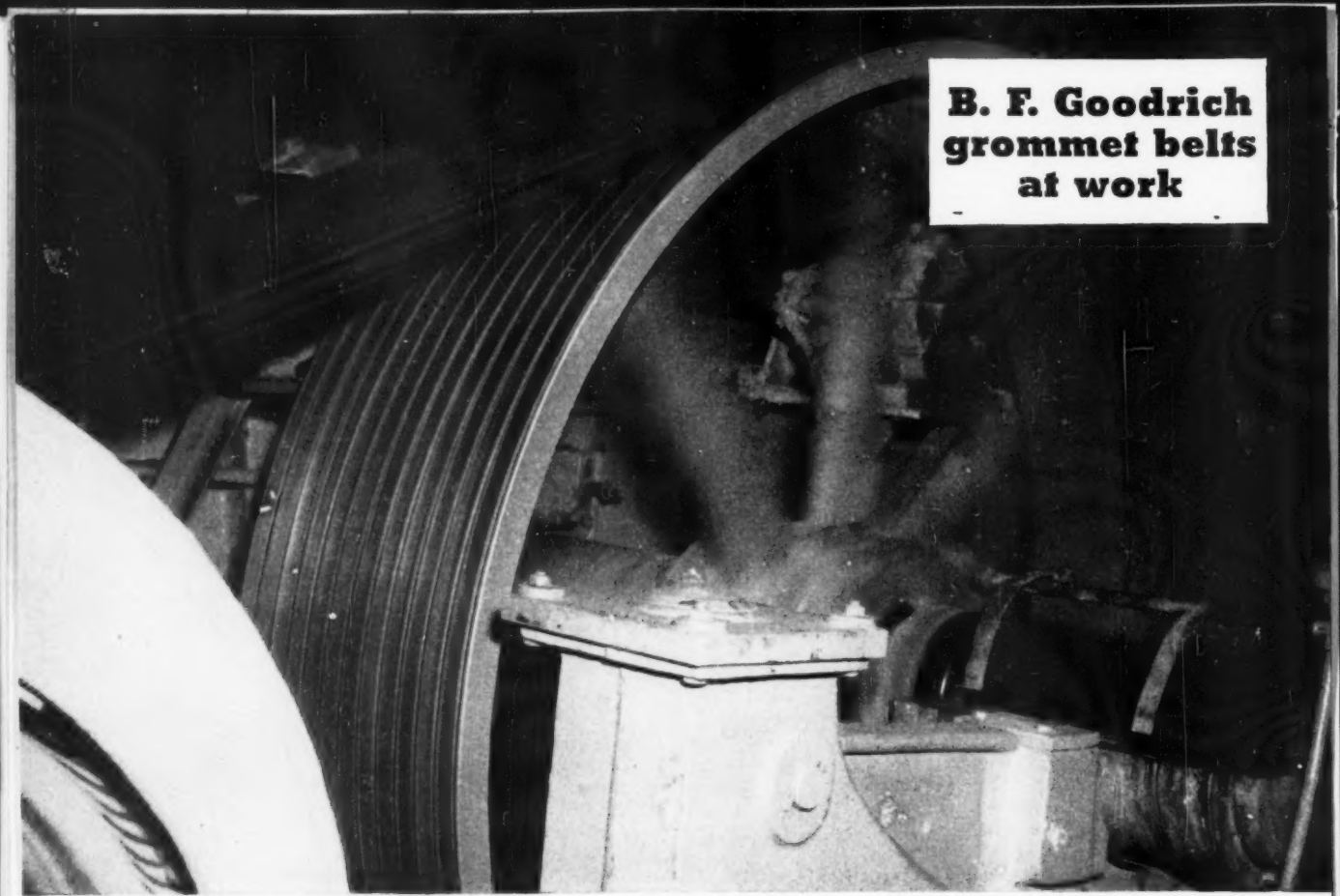
With grommet belts, you save on replacement costs because they last 20 to 50% longer. You save on production costs because machines keep running with fewer interruptions. And you save on maintenance costs because the V belts need less attention. Yet these savings they can make for you are all clear profit because grommet belts cost not one cent more than ordinary V belts.

Texas tall story ➸

These V belts operate on two floors in a Texas cotton gin, running cleaning machines where stalks are separated from cotton. Flat belts previously used couldn't take the constant flexing over small pulleys, were wearing out in only two months. Worse still was the constant maintenance. Every 24 hours the gin had to shut down while the belt was re-laced. Then grommet V belts were installed. They gave absolutely no trouble during the entire 1952 ginning season, show no sign of wear, and have increased production by giving uninterrupted service.



Belts previously used here took a lacing every 24 hours, lasted only two months.



Best by test

Driving a pulp beater is tough service for V belts. Heavy loads, shock, long hours often cause premature belt failure. One paper company decided to test several brands of V belts to check performance. All belts were installed at the same time on identical pulp beaters. B. F. Goodrich used the set of regular grommet belts you see in the picture. All other manufacturers put on "super", premium-priced belts. After 2½ years, the paper company engineers report complete superiority for BFG grommet belts from the standpoint of smooth operation, uniform stretch, absence of wear.

These typical examples (see preceding pages) tell you why B. F. Goodrich grommet belts are superior to ordinary V belts—prove they last 20 to 50% longer—yet cost no more.

The B. F. Goodrich Company
Department M-67
Akron, Ohio

☐ Send set of reports telling users' experiences and showing actual installations where grommet belts outlasted all others.

☐ Please have a BFG distributor call. I'd like to find how I can save money with grommet V belts.

Name_____

Firm Name_____

Address_____

City_____ Zone_____

State_____

Grommet V Belts BY
B.F.Goodrich
FIRST IN RUBBER

How to Solve Boiler Problems caused by

HIGH CIRCULATING RATES

Recent trends toward high circulating and high heat transfer rates mean that careful attention to water side protection of boiler surfaces will pay off in lower fuel costs and easier maintenance. Information that will help you analyze this problem and work out an effective solution is contained in Allis-Chalmers water conditioning Bulletin 43. It explains the problem. It tells what solution is available. And it tells how to apply this solution.

Based on Allis-Chalmers Experience

Bulletin 43 is one of a series of Allis-Chalmers bulletins on water conditioning problems. Each of these bulletins contains information that will help you solve some of your problems. They are based on Allis-Chalmers wide experience handling water problems for nearly every industry. In addition, they are based on Allis-Chalmers long experience building steam turbines and power plant equipment.

Complete Service Available

Allis-Chalmers gives you complete water conditioning service. You can get analyses and reports on your problems. You can get the chemicals needed in all water treatments. And you can get the equipment needed in any system.

A-4035

Equipment for all water treatments is available from Allis-Chalmers. Picture shows feeder installation similar to equipment used in water side protection of boiler surfaces.

For your copy of Bulletin 43 on internal treatment for water side protection of boiler surfaces, write Allis-Chalmers, Milwaukee 1, Wisconsin. Or better, call your nearby Allis-Chalmers district office and have an Allis-Chalmers representative consult with you on your water problems.

ALLIS-CHALMERS

NEWS ABOUT "TEFLON"

How Valve Components of Du Pont "Teflon"* Are Giving Improved Performance at Less Cost

Ever since Du Pont "Teflon" tetrafluoroethylene resin was developed, it has found an ever-increasing use as a material for valve components — gaskets, packings, seats and discs, plug valve components and diaphragms. It provides a unique combination of properties which are of particular interest to manufacturers and users of valves. Among these properties are:

- **CHEMICAL INERTNESS**

  Du Pont "Teflon" is completely unaffected by acids, alkalis, aliphatics, aromatics, chlorinated hydrocarbons . . . *all* chemicals except molten alkali metals, and fluorine at elevated temperatures.

- **HEAT RESISTANCE**

  Gives continuous service up to 500°F.

- **LOW-TEMPERATURE TOUGHNESS**

  Has been used satisfactorily at temperatures as low as—320°F.

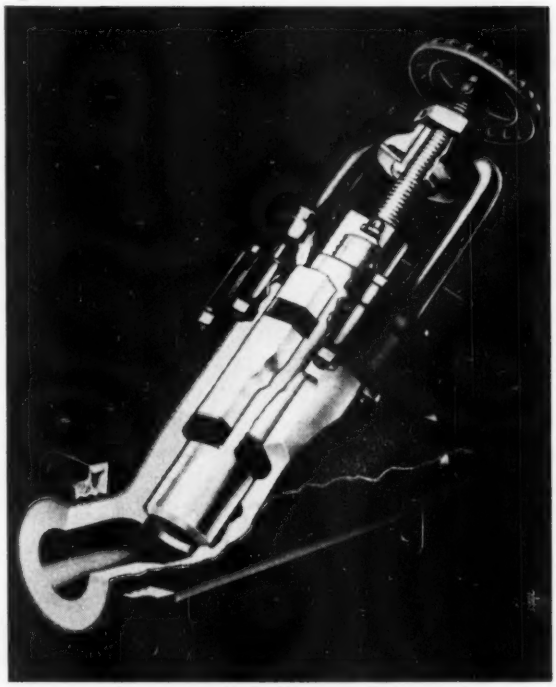
- **LOW COEFFICIENT OF FRICTION**

  Lets the valve operate more easily. Eliminates the need for lubrication.

- **EROSION RESISTANCE**

  Resists erosion by impinging fluids.

Here are some examples that show how valve components of Du Pont "Teflon" give outstanding performance and long service life . . . decrease production downtime, provide important savings in labor and material.



Chemical porcelain valve manufactured by the Lapp Insulator Co., Inc., Le Roy, N. Y.

GASKETS AND PACKINGS

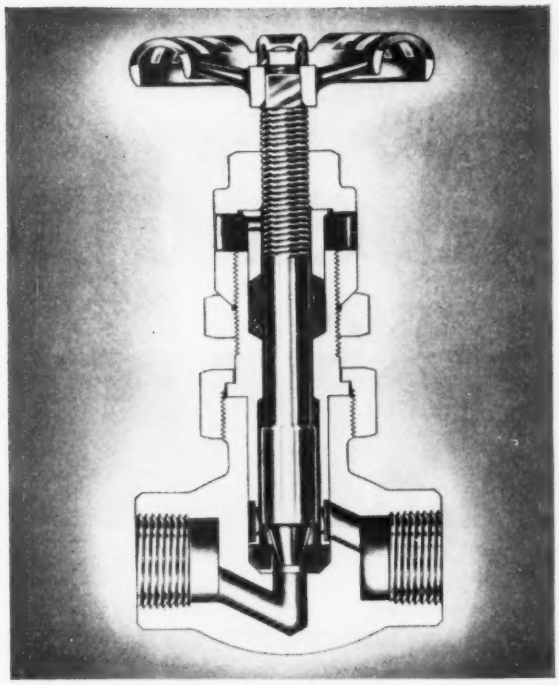
Gaskets and packings of Du Pont "Teflon" give outstanding performance—often last longer than the valve itself.

Packings of "Teflon" are now available in braided, bulk, impregnated, woven asbestos, extruded and molded forms. With such packings, gland nuts require only a minimum of tightening to achieve a tight seal. Less torque is required to operate the valve. In some cases such packings have permitted the miniaturization of the packing gland.

Gaskets of "Teflon" are now available in many forms, which include solid, jacketed, spiral wound, and asbestos and glass types impregnated with "Teflon." Many users have now standardized on packings and gaskets of Du Pont "Teflon."

Valves with components of Du Pont "Teflon" are being used by manufacturers and processors of:

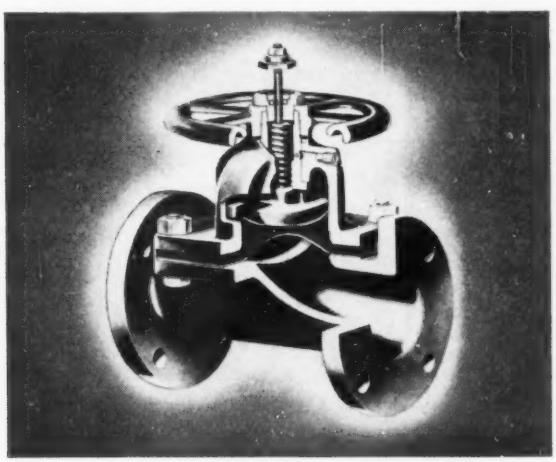
CHEMICALS	CHLORINE	DYES	EXPLOSIVES
FERTILIZERS	FOODS	INSECTICIDES	PAPER
PETROLEUM	PLASTICS	RUBBER	PHARMACEUTICALS
SOAP	SUGAR	TEXTILES	PHOTOGRAPHIC FILM



Needle valve manufactured by
Alloy Steel Products Co., Linden, N. J.

SEATS AND DISCS

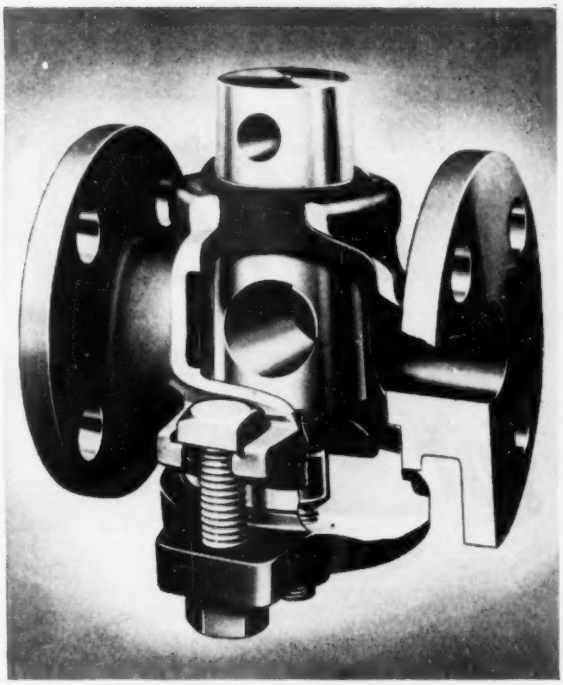
The success of "Teflon" in gaskets and packings led to its use as a seat and disc material. The use of "Teflon" has reduced the cost of manufacturing many types of valves by eliminating the need for lapping the disc into the seat, making valve parts interchangeable and simplifying design. Du Pont "Teflon" gives better performance where hot and corrosive materials are handled.



Saunders-Patent valve manufactured by
Hills-McCanna Co., Chicago, Ill.

VALVE DIAPHRAGMS

The chemical inertness and thermal stability of Du Pont "Teflon" have recently led to its development and use as a valve diaphragm. This diaphragm is pure "Teflon," and has been designed for continuous operation at pressures of 100psi and temperatures of 400°F.



Plug valve manufactured by
The Duriron Co., Inc., Dayton, Ohio

PLUG VALVE COMPONENTS

Used in plug valve components, Du Pont "Teflon" is especially valuable because of its low coefficient of friction and non-adhesive characteristic. These properties prevent the plug cock from sticking or freezing in the valve body. Before "Teflon" was developed, this problem was often overcome but required intricate design and costly fabrication. With "Teflon," these plug valve components have simplified design and are produced inexpensively. In one case, a plug valve sleeve was developed, and in another, a plug cock washer was used. In both cases, Du Pont "Teflon" gave excellent results.

The Polychemicals Department of the Du Pont Company supplies "Teflon" in the forms of molding powders and aqueous dispersions. These forms are converted into various valve components and molded articles by a number of manufacturers for use in chemical and allied equipment. For further information, write: E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Department, Room 268 Du Pont Bldg., Wilmington 98, Delaware.

*REG. U. S. PAT. OFF.

DU PONT
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BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY
Polychemicals
DEPARTMENT
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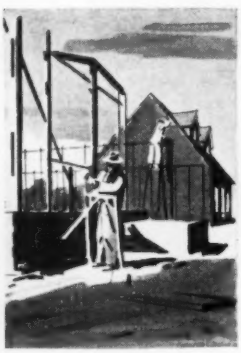
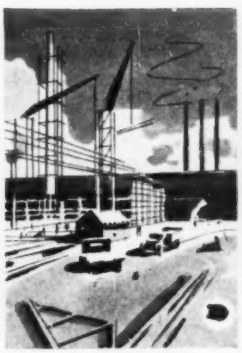
CHECK General for ELECTRICAL

AUTOMOTIVE - AIRCRAFT

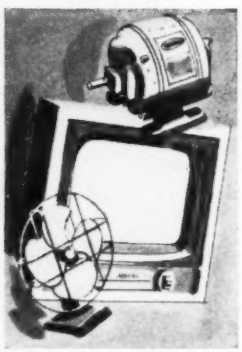
COMMUNICATIONS



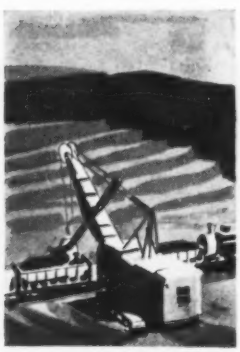
CONSTRUCTION



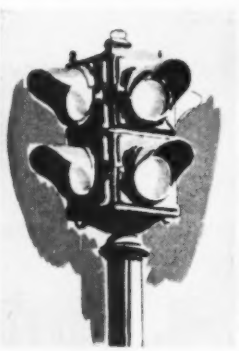
GENERAL INDUSTRY



MFRS. ELECTRICAL APPARATUS

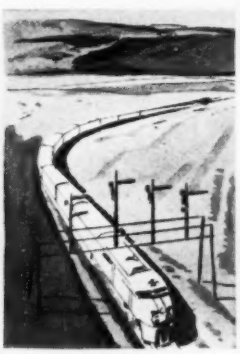


MINING - EARTH MOVING

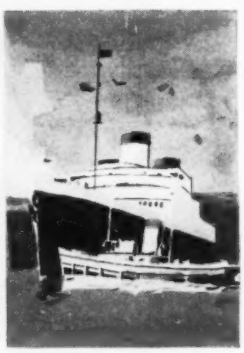


MUNICIPAL

POWER



RAILROADS



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Copper, bronze and aluminum conductors in thousands of different sizes and types of product. Constructions and insulations of every modern variety.

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Whatever your electrical wire and cable need, whenever you need it—say "General Cable" to your purchasing agent, your distributor—or call on the nearest General Cable office.

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ONE Standard of Quality

For Quicker Service Anywhere in the United States...General Cable maintains

22 Sales Offices

14 Resident Sales Representative Locations

Over **600** Distributor Sales Locations

6 Regional Stock Distribution Points

6 Manufacturing Plants and Stocks

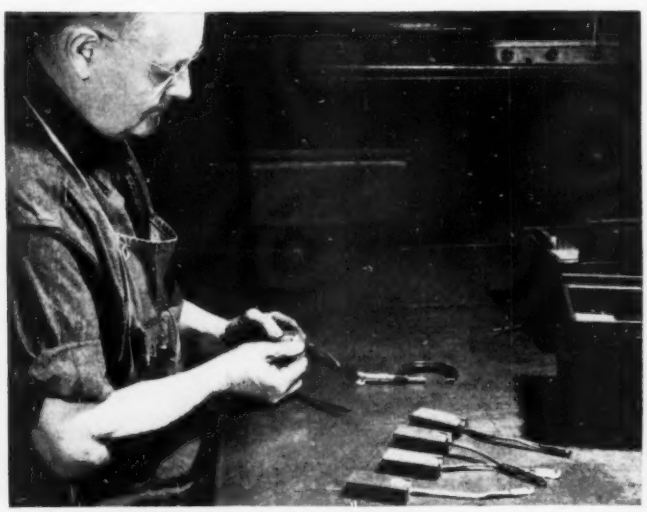
1878 75 1953 YEARS OF ELECTRICAL PROGRESS

ONE OF FIVE 2000-HP G-E SYNCHRONOUS MOTORS USED FOR AIR-COMPRESSOR DRIVES AT FORD MOTOR CO., ROUGE PLANT.

FOUR REASONS WHY G-E SYNCHRONOUS MOTORS

1. STRONG, FABRICATED FRAMES . . .

The welded steel-plate stator frame provides maximum rigidity in a comparatively lightweight construction. The sturdy channel-shaped frame consists of a wrapper plate firmly secured by continuous welds to rigid side plates. This design, proved by years of operating experience, affords more than ample strength for clamping and supporting the stator core.



2. G-E BRUSHES ON G-E MOTORS . . .

Brushes on G-E synchronous motors are a product of G-E teamwork. Close co-operation between machine designers and laboratory engineers means you get the right brush on the right motor for your particular application. In addition to extensive research and testing, all new and improved grades of brushes are thoroughly field-tested before approved for standard use.

Dependable G-E Synchronous Motors on 24-Hour Assembly-line Service

Ford Motor Company uses G-E synchronous motors for air-compressor drives

Compressor-motor dependability is really put to test on 'round-the-clock service at Ford Motor Company's Rouge plant. Compressed air is used 24 hours a day on many assembly operations, and a dependable supply is vital to keep production lines moving.

To furnish this all-important air, five 2000-hp G-E synchronous motors drive reciprocating compressors continuously—with only slight reductions in demand on certain shifts.

G-E synchronous motors can be relied upon for such continuous service with minimum downtime. You can depend on them because in back of every G-E synchronous motor stand more than half a century of motor engineering leadership . . . superior research and testing facilities to assure excellent component materials . . . and a corps of experienced craftsmen who are proud of the equipment they build—and build it to last.

The next time you consider a drive for heavy, continuous-service equipment be sure to call in your G-E representative to discuss any special application problem you may have. Have him explain the many money-saving uses for G-E synchronous motors and point out their operating economies.

In the meantime, you can obtain more information on G-E synchronous motors by writing for these publications: GEA-5332, "Low-speed Synchronous Motors," or GEA-5426, "High-speed Synchronous Motors." Write to Section 770-29, General Electric Co., Schenectady 5, N. Y.

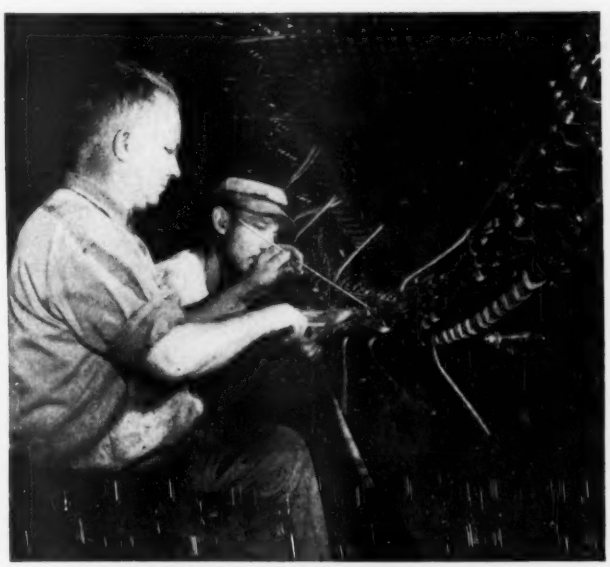
You can put your confidence in—

GENERAL ELECTRIC

GIVE LONG, DEPENDABLE SERVICE . . .

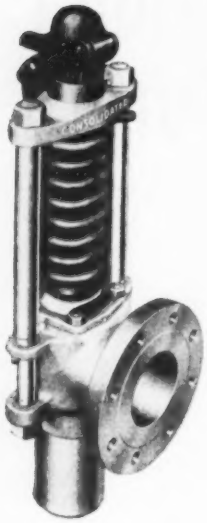
3. LONG INSULATION LIFE . . .

Insulating materials, manufactured in our own factories by the most modern methods, conform to rigid G-E specifications and are applied by experienced operators, above. Thus coils are uniform, interchangeable, mechanically rugged, and moisture resisting.



4. LOW-RESISTANCE CONNECTIONS . . .

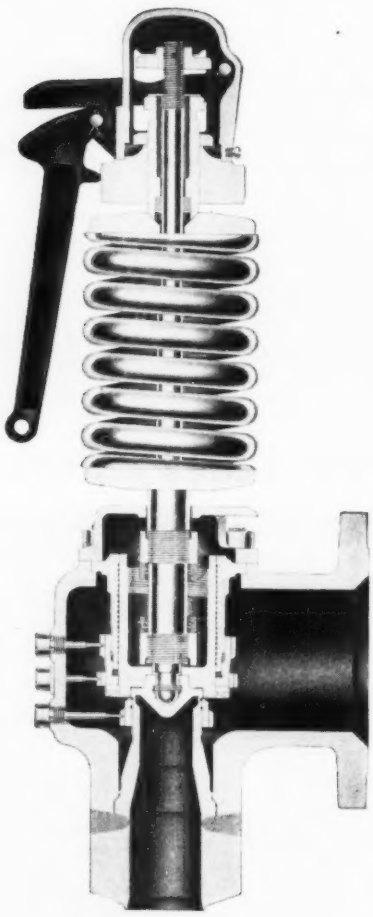
For dependable operation, stator windings are silver brazed, as shown above. Joints of this type have low electrical resistance, exceptional thermal and mechanical strength. These important properties are difficult to obtain by other methods.



MAXIMUM FLOW...

CONSOLIDATED *Maxiflow* SAFETY VALVES

Give you that—and more!



GREATER DISCHARGE CAPACITY that is there *when you need it* . . . tightness that you can depend on *month-after-month* . . . and other design features for high pressure, high temperature service mean one valve only — the Consolidated *Maxiflow* Safety Valve.

You can rely on the Maxiflow. Punishing laboratory tests and the toughest field services have demonstrated the functional ruggedness and dependability of the Maxiflow. Design advantages include:

Thermodisc Seat For Permanent Tightness. Equalizes temperature differentials when the valve reseats after blowing, minimizes thermal stresses, prevents seat distortion.

Design And Materials Assure Retention Of Popping Point. Special alloy steel is used to obtain stability of the spring support in the yoke rods, and a stainless steel spindle compensates thermally for any possible elongation of other parts that effect spring loading.

Controlled Blowdown. Simply and externally adjusted while the valve is under pressure.

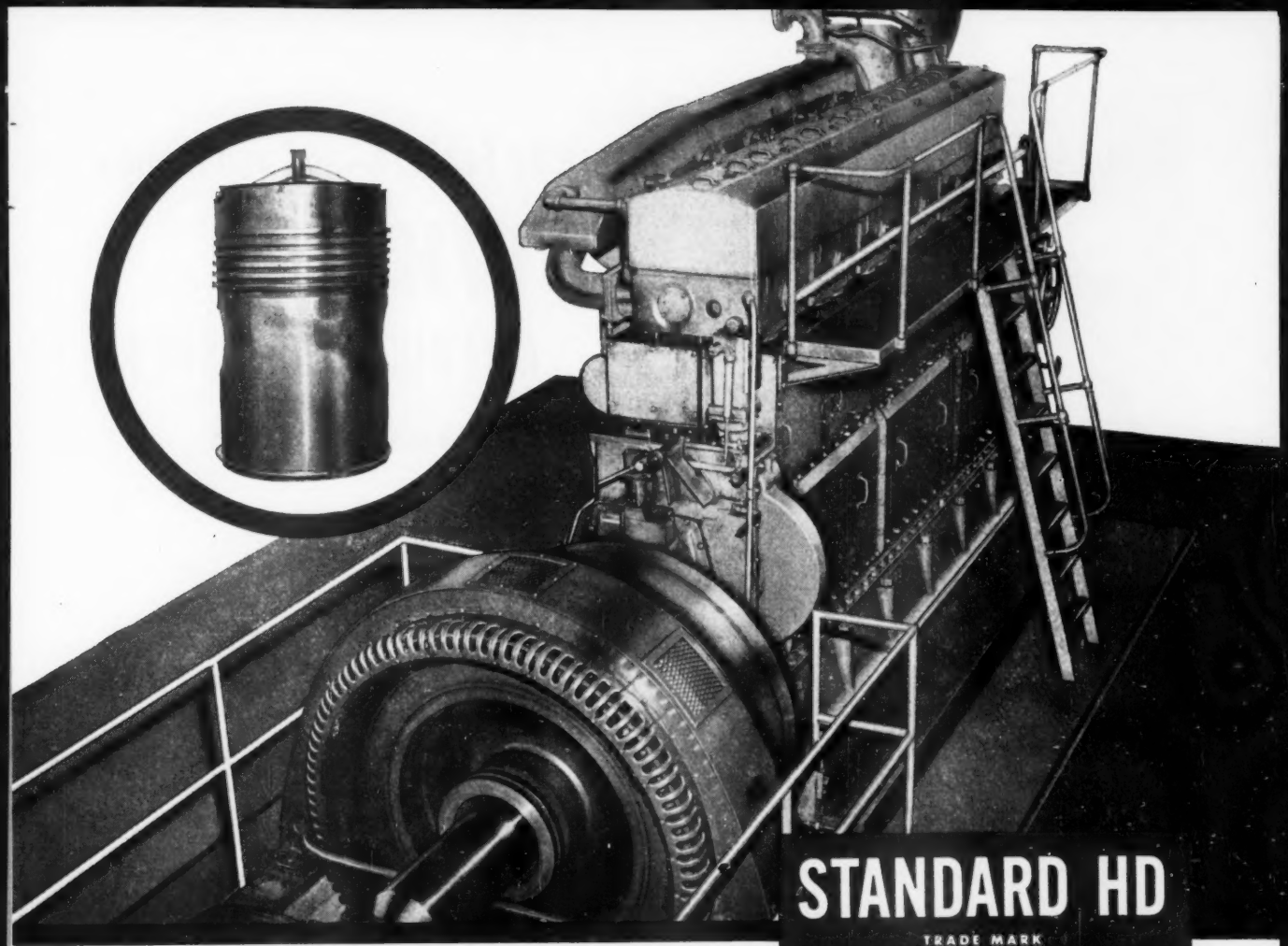
Forged Mechanical Through Bushing. Provides constant entrance conditions for steam flow. There is no leakage due to porous castings.

Whatever size safety valve you need — 1½", 2", 2½", 3", or 4" — choose Consolidated *Maxiflow*, the safety valve that sets a new standard in protection and service. Complete data, including capacity tables, are available in Bulletin 707. Write for a copy.

CONSOLIDATED SAFETY VALVES

A product of **MANNING, MAXWELL & MOORE, INC.** STRATFORD, CONN.

MAKERS OF 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'HANCOCK' VALVES, 'ASHCROFT' GAUGES. BUILDERS OF "SHAW-BOX" CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES.



STANDARD HD
TRADE MARK
OIL

21,000 hours young!

● This 1320-hp diesel engine has provided many hours of economical service for the City of Benson, Minnesota, Water and Light Department since it was installed in October, 1948. It has been operated on an average of 20 hours each day and has generated over 13 million KW at an average load factor of 75%.

In this hard-working diesel, the lubricating performance of STANDARD HD Oil has been outstanding, particularly in view of the fact that crude oil has been used as fuel. Visual evidence of the clean, protective lubrication provided by STANDARD HD is presented in the above unretouched photograph of a piston removed from the diesel after 21,000 hours' operation. Deposits are at a minimum; rings are free. The original fill of STANDARD HD has not been changed, yet a recent examination and analysis of the oil showed it to be in excellent condition.

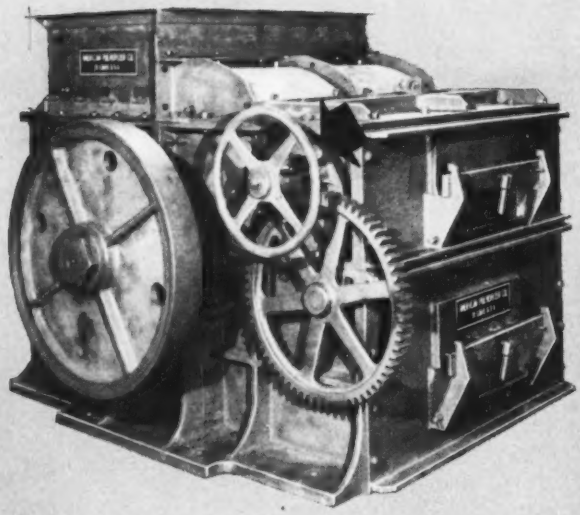
Diesel operators throughout the Midwest are receiving service like this from STANDARD HD Oil. The Standard Oil lubrication specialist serving in your section of the Midwest will be glad to give you information about the use of STANDARD HD in plants near your own. Just phone your local Standard Oil office. Or, write: Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY STANDARD *(Indiana)*

Check *American* Quality—Feature by Feature—and you'll know

WHY AMERICAN CRUSHERS can reduce coal for less than

per ton

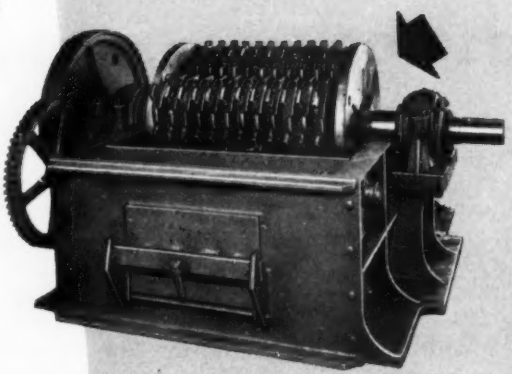


1 EASY ACCESS TO ADJUSTMENTS. Constant improvements in design over the years has produced a crusher with all adjustments *external*—and adjustable *while the crusher is in operation.*

AMERICAN Feature No. 4

COMPLETE ACCESSIBILITY TO PARTS AND ADJUSTMENTS

The entire frame of an American Crusher is of sectional design. This means easy, convenient dismantling for quick inspection or replacements in the crushing chamber. All members are securely bolted together with coupling bolts. Abutting joints are machined for a dust-tight fit. The result is a crusher designed for maximum operating efficiency, with minimum shut-down time or lost production.



2 EASY ACCESS TO PARTS. The rotor of an American Crusher, with its rows of American-Originated Rolling Shredder Rings, is readily accessible by removal of the top section. Rings can be reversed or replaced in a short time. Other parts, too, including the liners, are easily reached for periodical check.

Coal Samplers
Coal Crushers up to 800 TPH.
WRITE for special bulletin.

American PULVERIZER COMPANY

Originators and Manufacturers of Ring Crushers and Pulverizers

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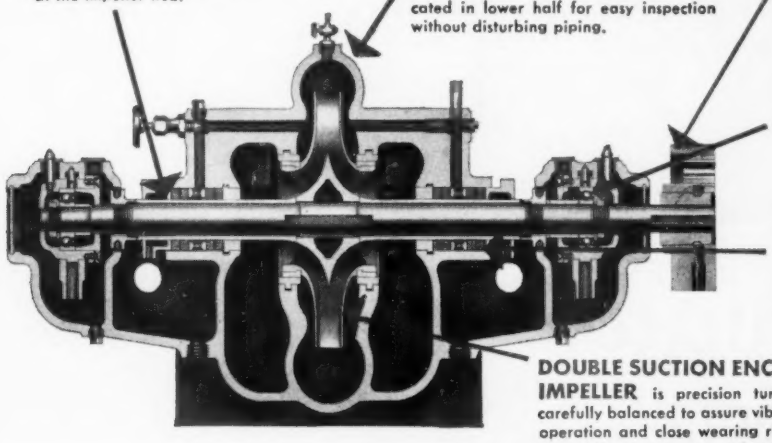
Look for These 7 Signs of GOOD PUMP DESIGN

CAST SHAFT SLEEVES, not commercial tubing, save the shaft from wear. Sleeves extend through the stuffing box and seal at the impeller hub.

HEAVY HORIZONTAL SPLIT CAST-IRON CASING construction with suction and discharge nozzles located in lower half for easy inspection without disturbing piping.

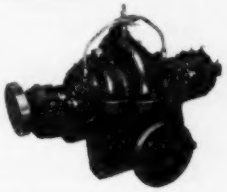
COUPLINGS have *Magic-Grip* quick change bushings for pump and drive shaft. Pin and rubber bushing type usually used. Removal for maintenance is easy.



BALL BEARINGS may be furnished for either oil or grease lubrication. Sleeve bearings also available in larger sizes.

GENEROUS STUFFING BOX LENGTH contains sufficient packing to keep stuffing box maintenance low. Provision is made for sealing water connections or for grease seal if these are required.

DOUBLE SUCTION ENCLOSED IMPELLER is precision turned and carefully balanced to assure vibrationless operation and close wearing ring clearance. Water passages are hand finished to a smooth surface.



STANDARD AND SPECIAL MATERIALS are available for many types of service where government regulations permit. Iron, bronze, stainless steel and combinations of these materials handle both alkaline and acid solutions. Standard sizes carried in stock range from 10 to 7000 gpm with heads as high as 475 feet.

THESE DESIGN AND CONSTRUCTION features of Allis-Chalmers double suction pumps assure long pump life and low maintenance costs. Every A-C double suction pump is carefully tested on the most modern pump testing equipment in the industry.

Complete Pumping Unit

Allis-Chalmers can furnish the complete pumping unit — pump, motor, control and drive — all of coordinated design and manufacture.

Whatever your pumping problem, call your nearby Allis-Chalmers Authorized Distributor or District Office. Or write for Bulletin 08B6146. Allis-Chalmers, Milwaukee 1, Wisconsin.

A-3952

Texrope, Magic-Grip, and Vari-Pitch are Allis-Chalmers trademarks.

Sold . . .
Applied . . .
Serviced . . .

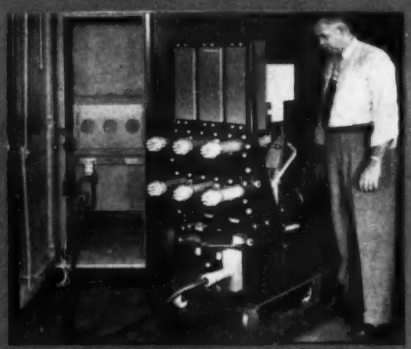
by Allis-Chalmers Authorized Distributors, Certified Service Shops and Sales Offices throughout the country.

MOTORS — ½ to 25,000 hp and up. All types.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE V-belts in all sizes and sections, standard and *Vari-Pitch* sheaves, speed changers.

ALLIS-CHALMERS



Test jumper facilitates breaker inspection, operation and maintenance at the station site.

Hard-to-get-at undersurfaces are protected against rust and corrosion by a heavy-rubberized sealing material.

Install Switchgear Outdoors

GET CONVENIENT OPERATION PLUS COMPLETE PROTECTION

When building-cost considerations suggest outdoor switchgear installations, you'll naturally want equipment that can be most conveniently operated and maintained in the open . . . and weatherproofed to protect against rust and corrosion. Westinghouse Outdoor Metal-Clad Switchgear meets these specifications.

Convenient Operation and Maintenance — Easily operated horizontal drawout circuit breakers eliminate lifting and lowering. A few turns of a crank connect or disconnect the breaker. Breakers of like rating are interchangeable and are easily rolled on the adjustable-height transport truck with its combination latching device for breaker and stationary structure.

Weatherproof Construction—Utilizing rigid, self-supporting, jig-welded construction features, Westinghouse Outdoor Metal-Clad Switchgear is equipped with a weatherproof housing, special underframe or base, and access doors at both front and rear of the unit. Space heaters and special ventilators in each unit reduce the possibility of condensation. As long-term protection against rust and corrosive elements, the metal frame is Bonderized, prime and finish painted, and the base receives a heavy spray application of all-weather undersurface coating.

For complete facts on outdoor or indoor metal-clad switchgear, write for Booklet 5306. Address: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-60793

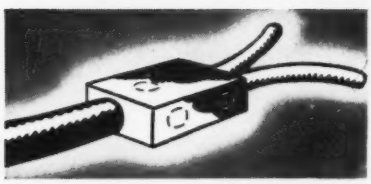
YOU CAN BE SURE...IF IT'S
Westinghouse

DESIGN TESTED AND VERIFIED in the Westinghouse HIGH POWER LABORATORY

METAL-CLAD SWITCHGEAR

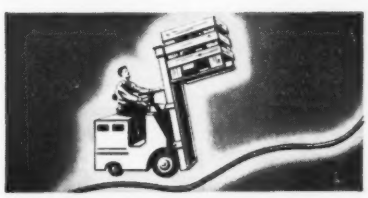
WESTINGHOUSE

How to get longer life out of your portable cords and cables!

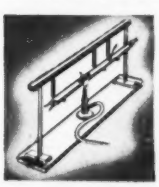


1 USE junction or distribution boxes for making multiple power connections in working places.

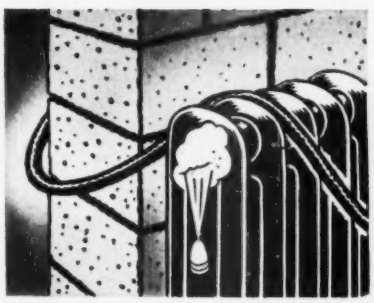
2 PROTECT cables with fuses or circuit breakers of the proper rating for the service. Make sure that circuit breakers will operate properly.



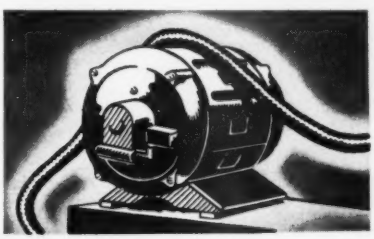
3 PROTECT cables from being run over by heavy equipment. Running over the cable a few times may not cause immediate failure, but may do internal damage which will shorten its life. If the cable must be run across an aisle, place boards on either side as one would for a hose. If it is in use for only a short time, it should be thrown over the truck.



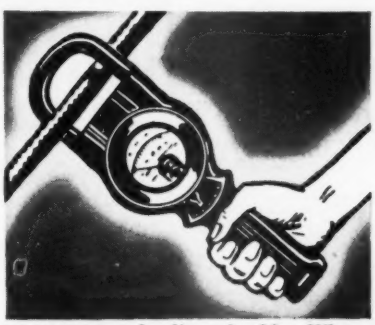
4 USE flame-resistant cables wherever possible.



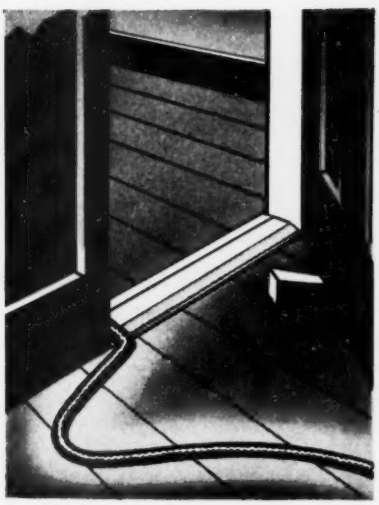
5 DO NOT have portable cords and cables running over steam pipes or other heat-transmitting equipment.



6 KEEP cables away from sparking motors and high voltage equipment. The ozone generated by sparking commutators attacks rubber jackets, causing cracking.



7 AVOID overloading of cables. Where possible, use I.P.C.E.A. recommended current ratings.

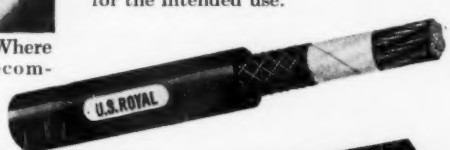


8 AVOID dragging portable cords around rough edges or sharp corners. Bruises and cuts hasten deterioration of the jacket. Never yank cords to remove kinks or loosen them when caught on a projection.

9 AVOID running portable cables on pulleys or drums too small for the size of the cable; observe recommended I.P.C.E.A. minimum diameters.

10 KEEP cords away from oils and greases. If they do get into oil, they should be wiped off as soon as possible. Avoid having cords lie in pools of water, chemicals or grease.

11 BUY cables that can carry the required current without overloading or overheating. They should be flexible (have sufficiently fine strands) for the intended use.



FOR FREE REPRINTS OF THIS PAGE, WRITE TO ADDRESS BELOW.

UNITED STATES RUBBER COMPANY

U.S. RUBBER
SERVING THROUGH SCIENCE

Electrical Wire and Cable Department

ROCKEFELLER CENTER • NEW YORK 20, NEW YORK

NEW!

LUNKENHEIMER
GLAND-TYPE
BRONZE NEEDLE VALVES

with fine thread-pitch for precision throttling

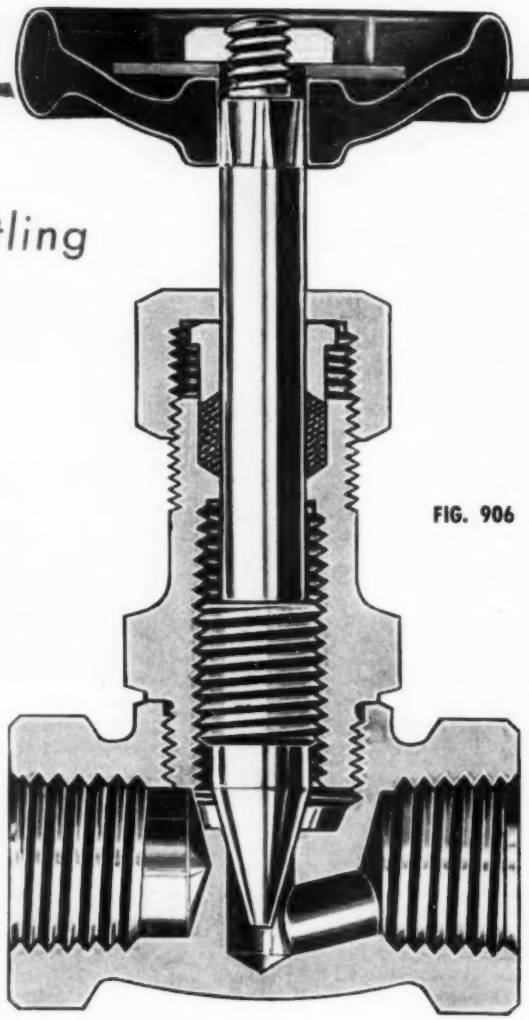


FIG. 906

● WHAT'S NEW ABOUT THEM?

They have a new gland follower . . . they're redesigned from handwheel to seat opening . . . and yet they're competitive in price with non-gland valves.

● HOW ARE THEY FOR INSTRUMENTATION?

Perfect. The handwheels lend themselves to delicate fingertip control. Fig. 1565 has a special indicator handwheel with numbered graduations and a spring lock, if you prefer. They're compact, to fit behind instrument boards, and they have a very fine thread-pitch for close regulation. The seat angle is 30°. They handle 200 lbs. Steam; 400 lbs. W.O.G.

● HOW ABOUT THE STEMS?

Take your choice of "Stemalloy"* or steel in the globe design. "Stemalloy"* is Lunkenheimer's exclusive wear-resisting bronze alloy. Steel stems are cadmium-plated to resist rust.

● WHERE CAN YOU FIND OUT MORE?

Ask for Lunkenheimer's new Needle Valve Bulletin 568. Your distributor has it, or we'll send you a copy. Write The Lunkenheimer Company, Box 360A, Cincinnati 14, Ohio.

BRONZE • IRON • STEEL

*Patented alloy

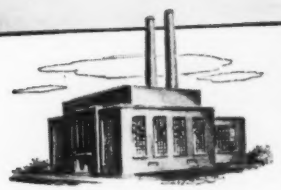
LUNKENHEIMER

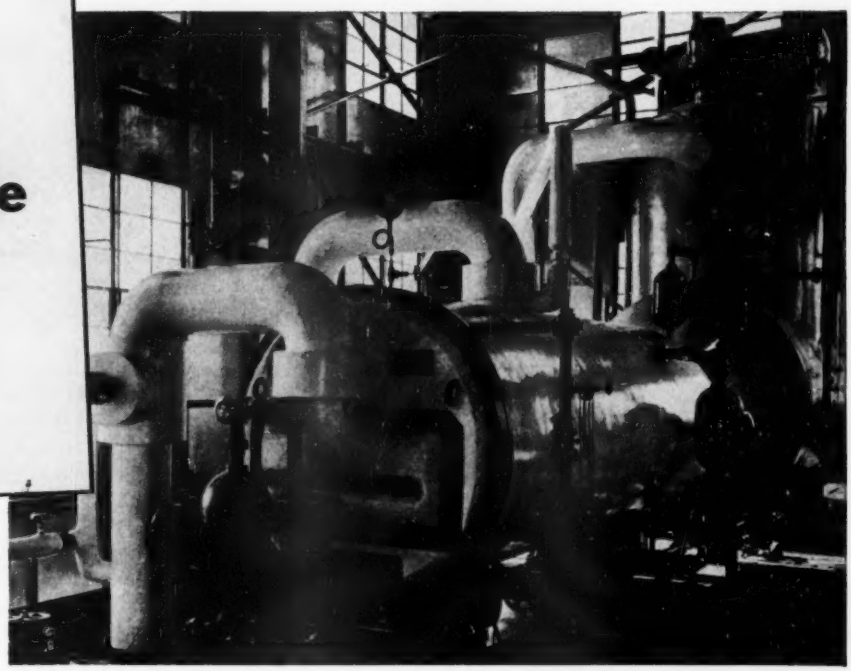
THE ONE *Great* NAME IN VALVES

L-552-27

Important!

if you have a moderate size boiler plant





Evaporators for eliminating the impurities from boiler feed make-up were originally developed for large power generating stations.

However, the results obtained with G-R Type R Horizontal and Type H Vertical Bentube Evaporators in industrial plants all over the country have proved that *moderate size plants* can also frequently profit by the many benefits of distilling the raw water supply.

This is a possibility well worth your investigation. Boiler feed purification by G-R Evaporators does not involve the use of chemicals nor require periodical water tests or manipulation by skilled operators. Moreover, it is the simplest method of eliminating raw water impurities.

Write for complete information.

THE GRISCOM-RUSSELL CO.
MASSILLON, OHIO

G-R Type R and Type H Evaporators are adaptations of the larger Type J-2 Bentube Evaporator—widely used by central power generating stations. They embody the exclusive scale-shedding G-R Bentube heating elements, and have many additional distinctive G-R features that assure ample capacity, pure dry vapor, long service, low maintenance expense and convenient attendance.

GR302

G-R HEAT TRANSFER APPARATUS **Bentube Evaporators**

Unloaded 3,207,708 Tons

ENGINEERING DATA

MODELS: 5-ton HD (Heavy Duty) . . . 3½-ton GS (General Service) . . . Both fit all hopper bottom cars in domestic service.

DUTY: GS Model generally recommended for 10 cars per day, HD Model up to 100 cars per day handling wet, compacted or partially frozen loads. (Capacity figures vary depending upon characteristics of material).

SPECIFICATIONS: 5/32" stroke—1,500 vibrations per minute (easily adjustable for specific applications) . . . Motor platform suspended on coil springs to protect motor from vibration . . . HD Model vibrating frame of welded construction throughout, stress relieved after welding . . . GS Model fabricated from rolled sections of riveted construction . . . Both Models available with recommended companion twin-hook Car Shakeout Hoist.

Patent No. 2,504,789

HEWITT-ROBINS INCORPORATED

HEWITT-ROBINS

EXECUTIVE OFFICES, STAMFORD, CONNECTICUT

and Never Missed a Day!

Customer's Performance Record

EQUIPMENT: Hewitt-Robins Heavy Duty Car Shakeout.

LOCATION: Bradford Dock of the Carbon Fuel Company, Kanawaha River, Marmet, W. Va.

OPERATION: Unloading coal from hopper cars.

PERFORMANCE: This Hewitt-Robins Heavy Duty Car Shakeout unloaded approximately 50 cars a day, every day for 6½ years without missing a complete day . . . unloaded a total tonnage of 3,207,708 tons . . . average unloading time of 2½ minutes per car under normal conditions (even partially frozen coal unloaded in 10 minutes). During this period of operation, the Car Shakeout has never been torn down and the original shaft, bearings and vibrator assembly are still intact . . . only maintenance required was replacement of V-belts and springs.

RESULTS: The Carbon Fuel Company reports that this unit has paid for itself *many times over in man-hours saving alone.* Now only four men are needed to handle car unloading operations at the dock . . . whereas, six to eight men were normally required before the Hewitt-Robins Heavy Duty Car Shakeout was installed.

CHECK FOR INFORMATION ABOUT THESE JOB-TESTED PRODUCTS FOR YOUR OPERATION

CONVEYORS:
- ☐ —Belt
- ☐ —Dock
- ☐ —Sectional
- ☐ —Vibrating

BELTING:
- *☐ —Elevator
- *☐ —General
- *☐ —Rayon
- ☐ —Woven Wire
- ☐ BUCKET ELEVATORS
- ☐ IDLERS

SCREEN CLOTH:
- ☐ —Electrically Heated
- ☐ —General
- ☐ VIBRATING SCREENS

HOSE:
- *☐ —Air
- *☐ —Fire
- *☐ —Flexible Rubber Pipe
- *☐ —Pinch Valve
- *☐ —Servall®
- *☐ —Steam
- *☐ —Twin-Weld®
- *☐ —Water
- ☐ MECHANICAL FEEDERS
- ☐ STACKERS
- ☐ CAR SHAKEOUTS

TRIPPERS:
- ☐ —General
- ☐ —Dust Seal
- ☐ BELT CLEANERS
- ☐ CRUSHERS
- ☐ STOCKING & RECLAIMING SYSTEMS
- ☐ DESIGN AND CONSTRUCTION OF COMPLETE MATERIALS HANDLING SYSTEMS

*For immediate information about these industrial rubber products, call your Hewitt Rubber Distributor (See "Rubber Products" Classified Phone Book).

Hewitt-Robins Incorporated
666 Glenbrook Road
Stamford, Connecticut

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TITLE & COMPANY

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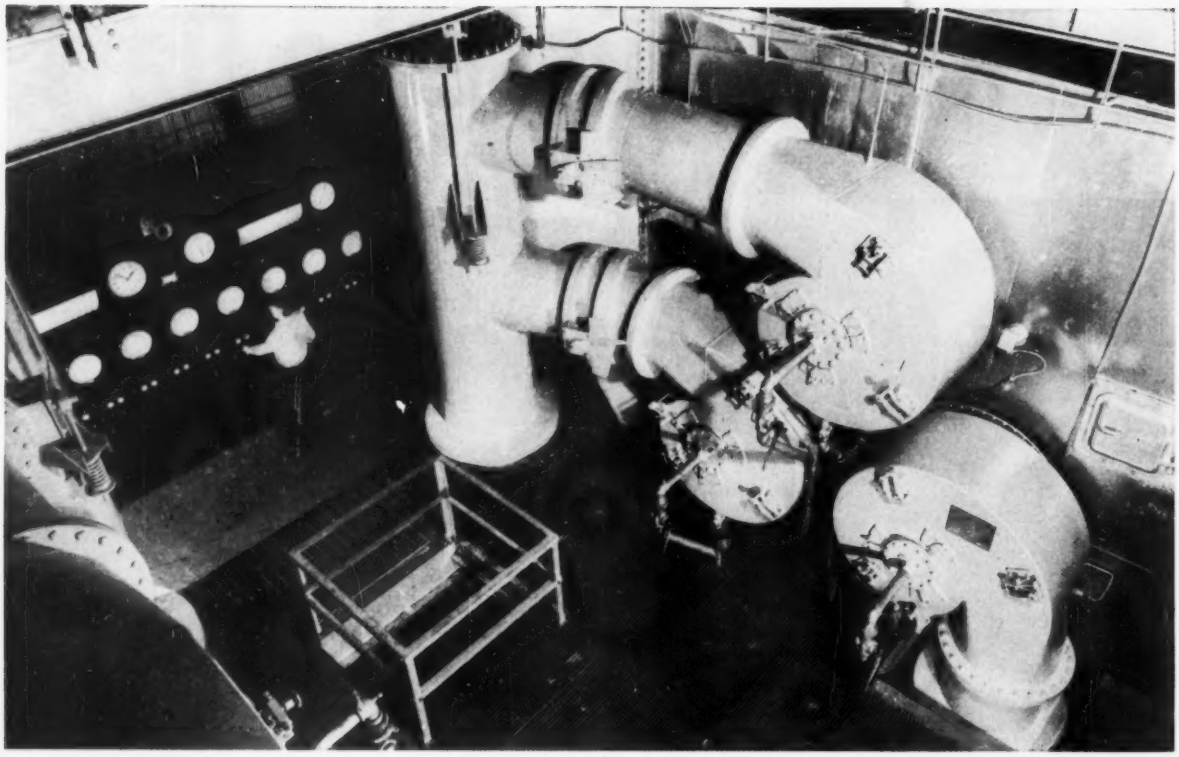


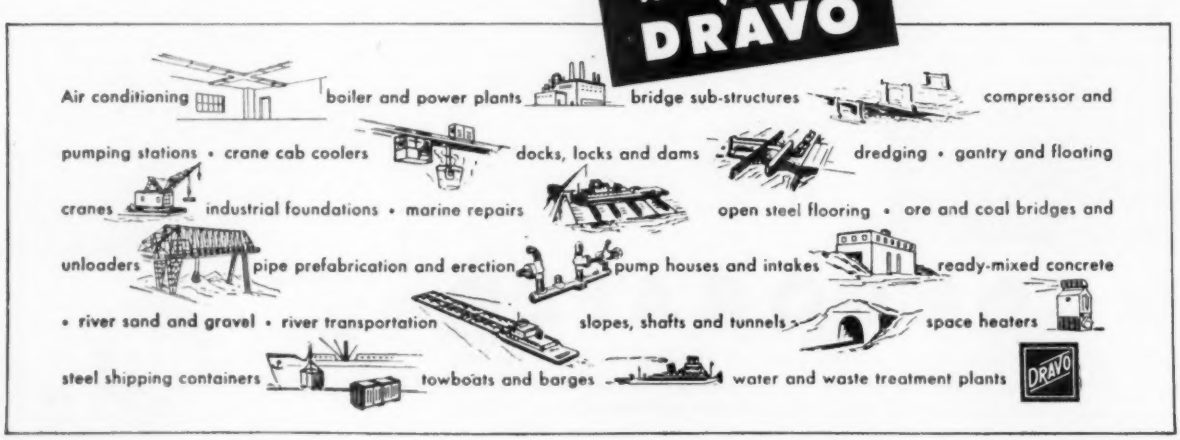
ANOTHER DRAVO-BUILT J&L BOILER PLANT

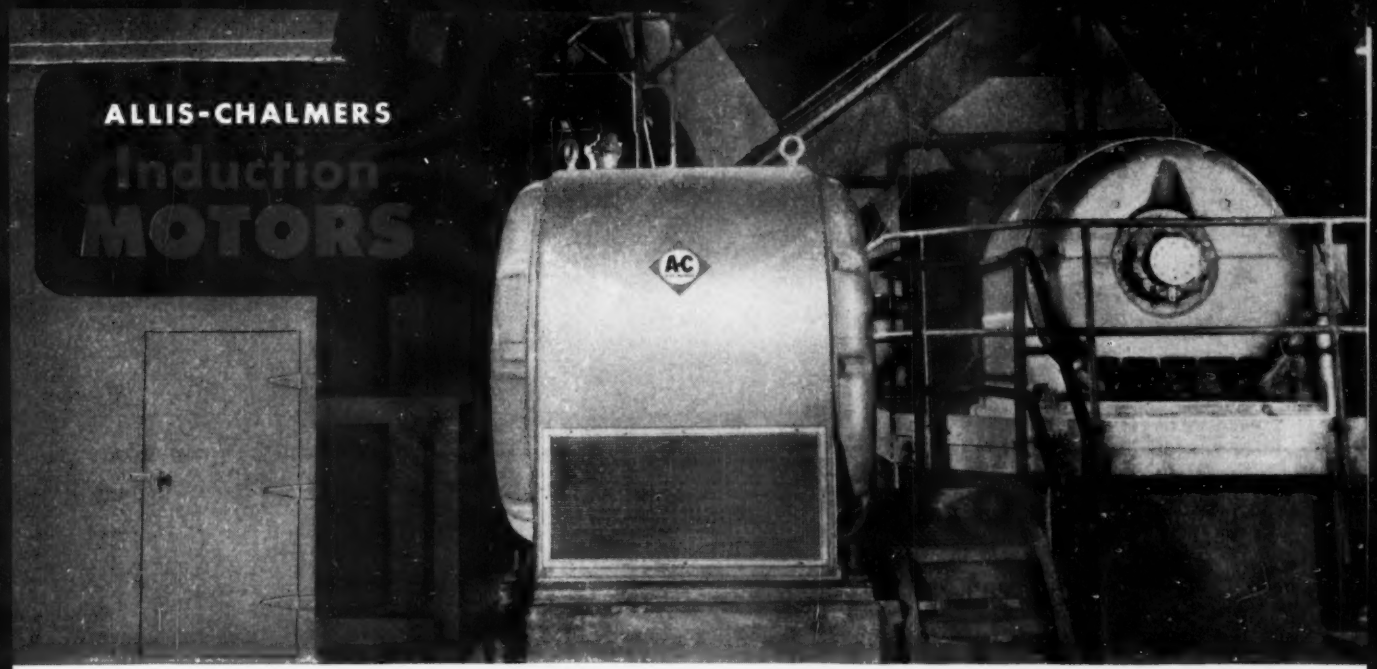
A good example of how Dravo Corporation serves as a complete "Construction Department" for industry is the story behind the erection of a new boiler plant at Jones & Laughlin Steel Corporation's Cleveland Works.

Dravo handled the entire job on a "turn-key" basis. In this capacity, Dravo furnished the materials, erected the building, installed the boilers and auxiliary equipment, fabricated the pipe at its Marietta Plant, erected it, and supplied the Tri-Lok Open Steel Flooring. The completed plant was turned over to J&L . . . ready for operation.

Dravo has often performed in this manner for utilities and industry, delivering to the customer a completed power station, boiler plant, water-pumping station, pipeline facility, water or waste treatment plant. Many customers have taken advantage of Dravo's 60 years of experience in all types of engineering construction and have benefited through the savings made possible by Dravo's single-contract responsibility.

Why not find out today how Dravo can be of service to you? Write or call the Construction Department, Dravo Corporation, Fifth and Liberty Avenues, Pittsburgh 22, Pennsylvania.





Left to right (above) are drip-proof, silicone insulated, 1000-hp, forced and induced-draft fan motors for unit No. 2. Forced draft fan motors for unit No. 3 will be of the weather-protected type for installation outdoors.

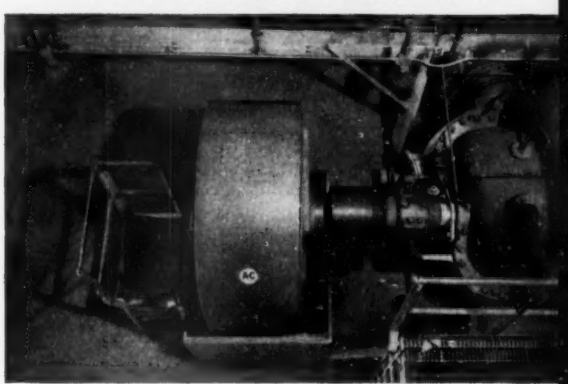
LET'S TAKE A LOOK AT TANNERS CREEK

One thing you're sure to notice at the Tanners Creek plant is that all the major auxiliaries for generating unit No. 2 are driven by Allis-Chalmers motors. Pictured here are a few of the larger ratings in this modern power plant of Indiana & Michigan Electric Company, a part of the American Gas and Electric system.

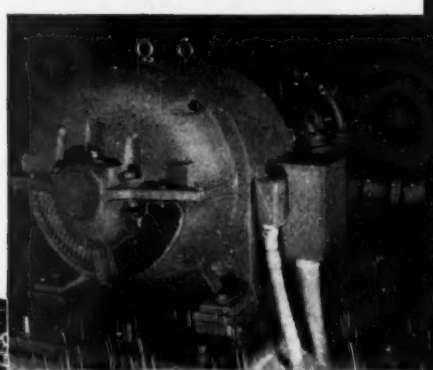
It's worthy of note that A-C is also building the motors for generating unit No. 3, scheduled for operation in 1954.

Allis-Chalmers builds a complete line of integral horsepower motors for power plant service, and your A-C representative can help you select the motors you need.

A-4084



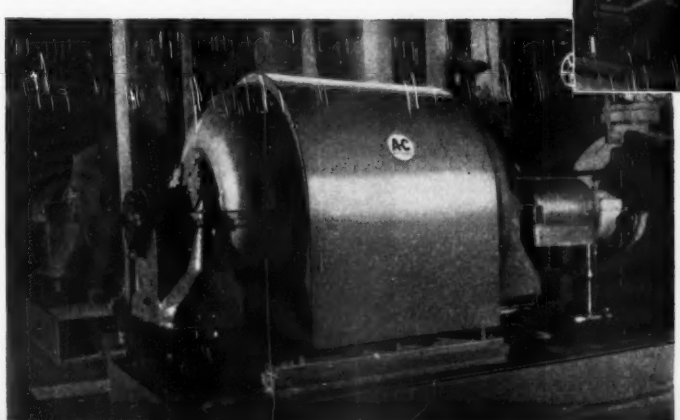
One of two 300-hp, 2300-volt, 218-rpm, drip-proof squirrel-cage motors driving circulating water pumps.



Rated 200 hp, 2300 volts, 1760 rpm, this drip-proof squirrel-cage motor driving an Allis-Chalmers screen wash pump is typical of the smaller ratings.

ALLIS-CHALMERS

Milwaukee 1, Wisconsin



These dependable boiler-feed pump motors are rated 2000 hp, 2300 volts, 3580 rpm each.

THREE BASIC REASONS

for using HAGAN
RING BALANCE
INSTRUMENTS

and HAGAN
AUTOMATIC COMBUSTION
CONTROLS

HAGAN
HALL
BUROMIN
CALGON

VERSATILITY

Hagan Ring Balance Instruments and Hagan Automatic Control units are the most versatile machines available for equivalent service today. Whatever your requirements may be, Hagan equipment can be selected to fit exactly your measuring, controlling, and recording or integrating problems.

DEPENDABILITY

An outstanding feature of Hagan Ring Balance Instruments and Hagan Automatic Controls has always been consistent dependability—with reliable performance throughout a long life, and with minimum maintenance costs.

ACCURACY

Maximum accuracy is designed and built into every Hagan Ring Balance Instrument and Hagan Automatic Control unit. This assures high operating efficiency for your plant, and savings which usually amount to many times the cost of the equipment.

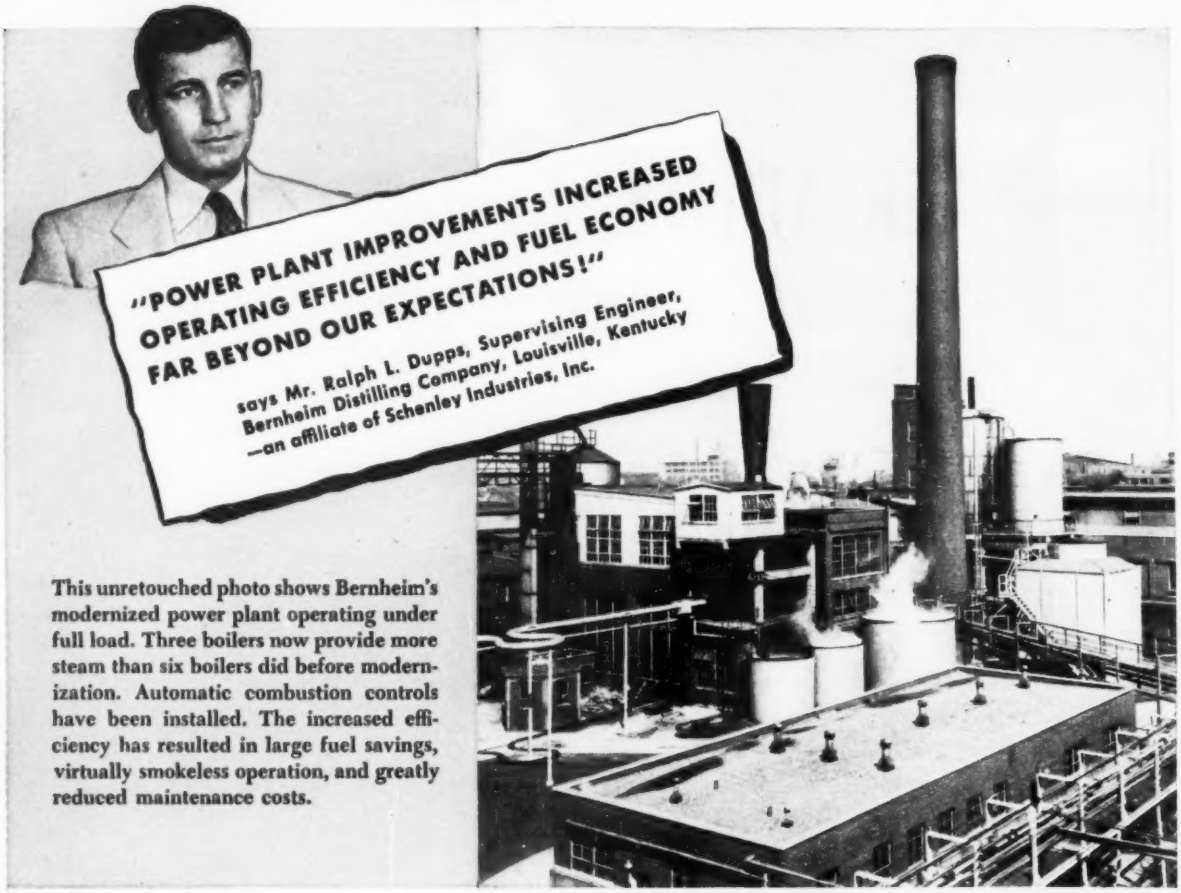
Whatever your control or instrumentation problems, let Hagan engineers help you solve them. Their experience, gathered from thousands of successful installations, is at your service.

Hagan Corporation

HAGAN BUILDING PITTSBURGH 30, PENNSYLVANIA

BOILER COMBUSTION CONTROL SYSTEMS
RING BALANCE FLOW AND PRESSURE INSTRUMENTS
METALLURGICAL FURNACE CONTROL SYSTEMS
CONTROL SYSTEMS FOR AUTOMOTIVE AND
AERONAUTICAL TESTING FACILITIES

"WE CUT OPERATING COSTS $67,000 A YEAR— BY BURNING COAL THE MODERN WAY!"


"POWER PLANT IMPROVEMENTS INCREASED OPERATING EFFICIENCY AND FUEL ECONOMY FAR BEYOND OUR EXPECTATIONS!"
says Mr. Ralph L. Dupps, Supervising Engineer, Bernheim Distilling Company, Louisville, Kentucky —an affiliate of Schenley Industries, Inc.

This unretouched photo shows Bernheim's modernized power plant operating under full load. Three boilers now provide more steam than six boilers did before modernization. Automatic combustion controls have been installed. The increased efficiency has resulted in large fuel savings, virtually smokeless operation, and greatly reduced maintenance costs.

Why not take *full* advantage of coal's economy? Cut your operating costs to a minimum with automatic coal- and ash-handling equipment. Get more steam for every dollar with an up-to-date combustion installation.

Whether you're building a new plant, or planning to modernize, a consulting engineer can show you how you can get big savings by burning coal in a modern plant designed to meet your *specific* needs.

Consider, too, that of all fuels, coal alone has virtually unlimited reserves. And America's coal industry leads the world in efficient, economical production. That means that, unlike other fuels, ample coal will be available in the future—and at relatively more stable prices.

If you operate a steam plant, you can't afford to ignore these facts!

COAL in most places is today's lowest-cost fuel.

COAL resources in America are adequate for all needs—*for hundreds of years to come.*

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

BITUMINOUS COAL INSTITUTE

A Department of National Coal Association, Washington, D. C.

FOR HIGH EFFICIENCY FOR LOW COST

YOU CAN COUNT ON COAL!

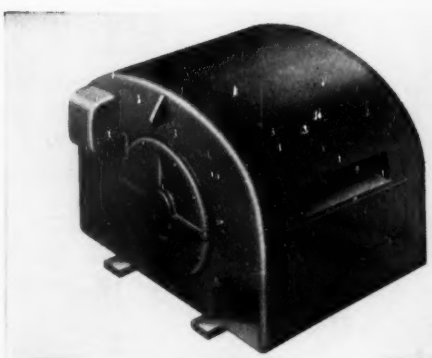
DALLAS POWER & LIGHT SAYS:

"G-E Weather-Protected Motors Give Us Dependable Service."

The Dallas Power & Light Company reports complete satisfaction with G.E.'s Weather-Protected Motors, used to drive induced draft fans. Developed by General Electric in 1949, they are the first successful outdoor ambient breathing motors—give outdoor protection at lowest possible cost.

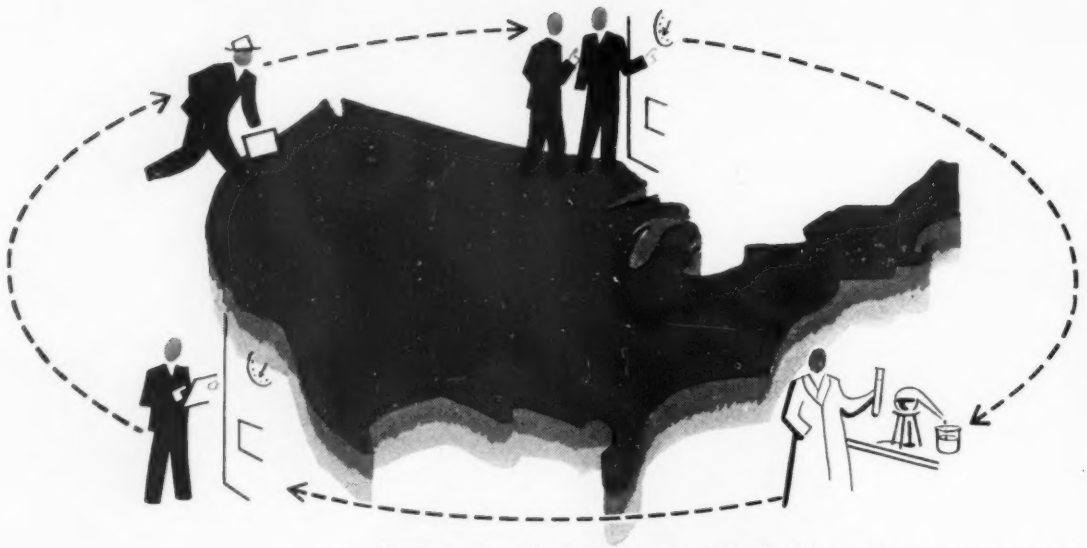
General Electric's Weather-Protected Motors are available as Base Ventilated for high shaft applications and as Grade Mounted for low shaft applications. They have an effective low air velocity, air reversal system which practically eliminates moisture, dust, and other foreign materials from the cooling air.

For full data, contact your G-E Apparatus Sales Office or write for Bulletin 5810 to General Electric Co., Section 753-4, Schenectady 5, New York.



GRADE MOUNTED Weather-Protected Motors are designed so that driven rain, etc. blows *through* the air inlets—not into motor.

GENERAL ELECTRIC



Over two million miles of service!

Drew Power Engineers are not limited by miles or places when it comes to prompt water conditioning service.

During 1952, Drew engineers traveled over 2,000,000 miles to survey, treat and control all types of industrial water problems.

To each Drew client, these experienced men brought the most modern treatment materials and techniques developed by years of continuing research on scale, corrosion, sludge and other water problems.

The Drew representative nearest you can be of great help in lowering your maintenance costs, preventing expensive breakdowns in your plant. Call him without obligation.

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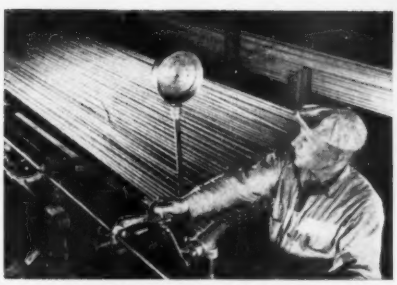
Chase Antimonial Admiralty

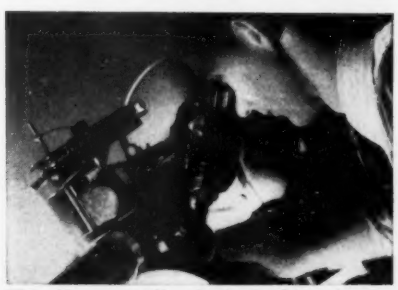
(a patented alloy)



Every Chase Antimonial Admirally condenser tube is tested to withstand at least 1,000 pounds per square inch water pressure.

Meets every test for Condenser Tubes

Chase flattening test, index of Antimonial Admiralty tube's physical quality and ability to withstand bending or end flaring.



This Chase metallurgist is checking the size and uniformity of grain of Chase Antimonial Admiralty condenser tubes.

When you put Chase Antimonial Admiralty* tubes into a condenser you *know* they'll stand up for years. It isn't only that we make certain there's enough antimony to resist dezincification. Chase condenser tubes are carefully tested and retested for *every* physical and chemical property required to meet actual field conditions. It pays to insist on Chase Antimonial Admiralty.

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IF IT'S MINED, PROCESSED OR MOVED

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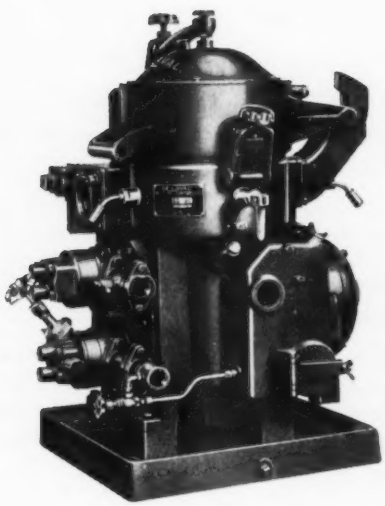
NO GETTING AROUND IT!

A De Laval Centrifuge Costs Much Less Than "Down" Time

The cost of a De Laval Centrifugal Oil Purifier of any given size is only a fraction of the cost of the prime mover it protects. There's no denying it, the comparatively modest investment represented by a De Laval Oil Purifier is far outweighed by the cost of even one serious shutdown. A De Laval machine is truly inexpensive insurance.



A De Laval Oil Purifier instantaneously removes from lube oil, all water, dirt or sludge by means of centrifugal force, keeping the oil clean and safe. The water is discharged continuously. Moreover, every De Laval machine correctly selected for size in the first place, has ample reserve capacity to take care of a sudden water leak.

Naturally, any solid contamination is thrown out of the oil and stored out of the zone in which purification takes place.

De Laval protection is *complete* protection!

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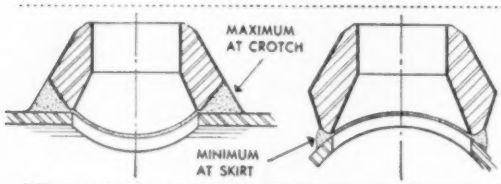
FOR MORE DEPENDABLE POWER PRODUCTION

WELDOLET WELDING FITTINGS
MEAN PERMANENT PIPING
. . . PERMANENT SAVINGS

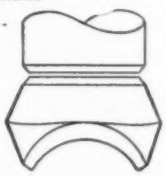
Here's Why >

Every fitting is shaped to fit the pipe and is self-aligning.

The template is the inside of the fitting. The hole in the run-pipe can be cut out either before or after the fitting is installed.



Welded as indicated—to fill in 50° bevel at crotch, blending into 35° bevel at skirt—full reinforcement is accomplished.



The outlet is machine-beveled for quick, easy butt-welding of the branch pipe—shop or field fabrication.

Here's How >

1. The WeldOlet is raised off the run pipe to establish proper weld gap, as required by Code for all types of branch connections. This is accomplished by placing spacers, e.g. welding rods, under the fitting.
2. The base joint is tack welded, preferably at four points, each half way between the crotch and skirt sections of the fitting. The spacers are then removed.
3. The stringer bead—or beads—is applied completely around the base of the fitting. The established weld gap assures full penetration.
4. Additional passes are applied as necessary to fill in the tapered base bevel of the fitting. The intermediate passes should not be continuous. Re-inforcing welds should be made at the crotch bevel area at each side of the fitting only. A continuous cover bead should be added, filling the bevel at the base of the fitting at the crotch and skirt sections.

TO COMPLETELY SAFEGUARD AGAINST:

- high pressures
- high temperatures
- internal corrosion
- external stresses

TO PROVIDE:

- improved fluid flow
- trouble-free and permanent piping systems

TO ACCOMPLISH ALL THESE THINGS IN THE MOST ECONOMICAL MANNER . . . SPECIFY AND USE

BONNEY WELDOLET WELDING FITTINGS

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ALLENTOWN, PENNSYLVANIA

Notes Afloat

THIS is just a vacation letter, a rambling personal note from Scandinavia, so turn the page now if you're a busy engineer with work to do. There's nothing here to help you run a plant—just a few tips on the art of having fun, an art we're all apt to forget.

For many years I've dreamed of sailing a boat up the west coast of Sweden to Oslo, Norway. This is it: We are now heading up the Oslofjord.

We left Gothenberg, Sweden, a week ago in the chartered 39-ft auxiliary sloop *Kullan III*. The party includes wife, daughter and a wonderful guy—Capt Sten Sellström, chief inspector of the Gothenberg Board of Trade. Sten is a first-class sailor. He's a great help in reading the Swedish and Norwegian charts and dickering for supplies ashore. Best of all, he has cruised these waters since childhood and knows them well.

We've followed a tortuous course among hundreds of rocky, treeless islands. The scenery is magnificent; this is one of the world's finest cruising grounds. I recommend it to any POWER reader looking for a unique vacation. If you don't sail yourself, you can take a steamer running from Gothenberg to Oslo by way of the islands.

But if you want to stop off at the pleasant fishing villages, you have to do some harbor-hopping in smaller craft. In your own boat, the way we went, you see everything, and it's wonderful.

Every few miles you come upon a red-roofed fishing village tucked away in some cranny of the great rocks on a bare, lonesome island. You imagine a primitive life, then go ashore to find well-dressed, happy people living in neat, clean houses—virtually all have electricity.

It's the Swedish way, one you can't help admiring. Sweden, by the way, has the highest living standard in Europe. The people seem to live almost as well as Americans, but in a simpler way, with far fewer cars and fewer household appliances.

They show great enterprise in getting the abundant hydro power to hundreds of islands by way of a network of submarine cables and pole lines running over the rocks. Afloat, the Swedes are power-minded also—their sturdy fishing boats are diesel driven.

But I didn't come here to make a power study. This is vacation time and I hope all of you, in your chosen places and ways, are having as much fun as I am.—PWS

"We Saved Money and got better Protection for TWO Customers by switching to FUSETRON *dual-element* FUSES"

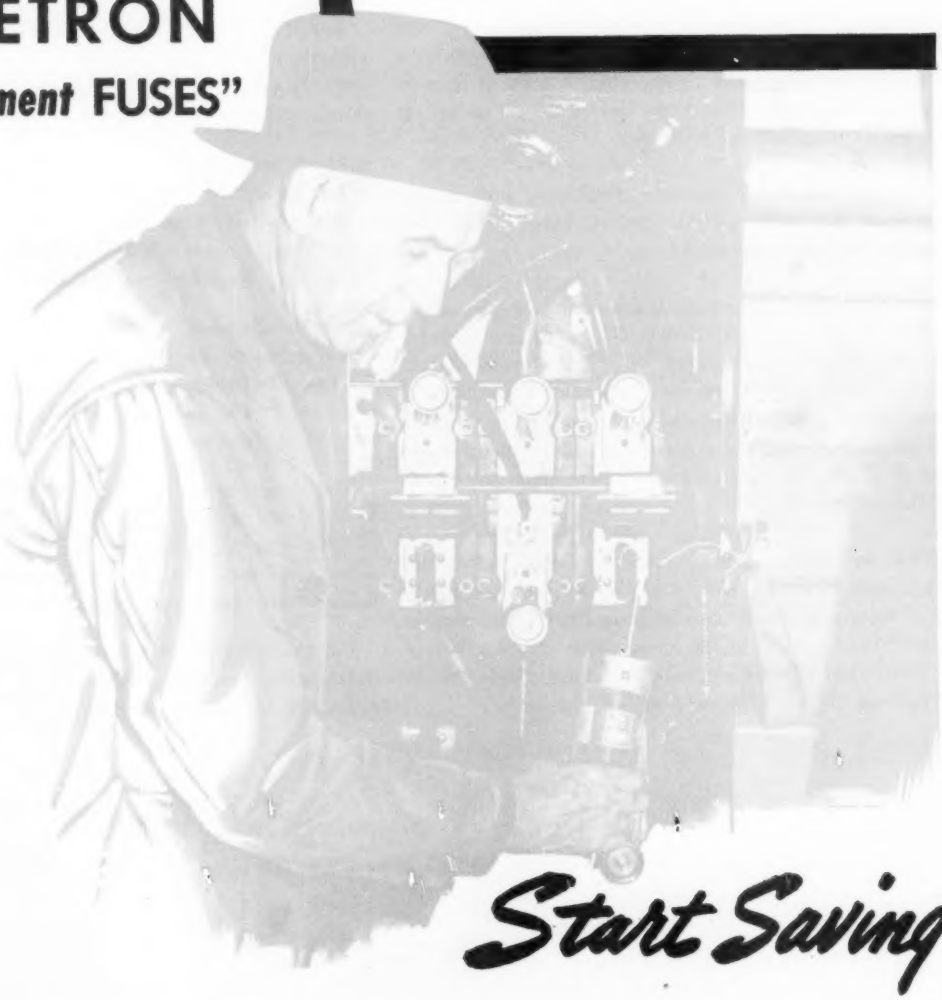
"Fusetron Fuses made it possible to use smaller size switch."

"Early this year I had the opportunity to lay out a wiring job for the Nehi Bottling Works at Boise, Idaho.

"After figuring the job with ordinary fuses it was found necessary to use a 400 ampere 250 volt main switch to carry the load.

"The proprietor of the bottling works felt that the cost was too great. I, therefore, refigured the job with Fusetron fuses and I found that I could use a 200 ampere 250 volt switch which besides being less expensive would result in better protection.

"Needless to say the proprietor was happier with the lower cost and I received the electrical contract."



Start Saving

FUSETRON dual-element FUSES do more than protect against short-circuits —they give 10 POINT PROTECTION

1 Protect against short-circuits.*

2 Protect against needless blows caused by harmless overloads.

3 Protect against needless blows caused by excessive heating — lesser resistance results in much cooler operation.

4 Provide thermal protection — for panels and switches against damage from heating due to poor contact.

5 Protect motors against burnout from overloading.

6 Protect motors against burnout due to single phasing.

7 Give DOUBLE burnout protection to large motors — without extra cost.

8 Make protection of small motors simple and inexpensive.

9 Protect against waste of space and money—permit use of proper size switches and panels.

10 Protect coils, transformers and solenoids against burnout.

*Fusetron Fuses have high interrupting capacity as shown by tests of the Electrical Testing Laboratories of New York City in December, 1947.

FUSETRON is a trade mark of the Bussmann Mfg. Co., Division of McGraw Electric Co.

"Heating in a main switch was causing fuses to blow until a Wholesaler's Salesman showed us how to cure the trouble with FUSETRON dual-element Fuses."

"During 1948 I was confronted with a bad heating problem in a 600 ampere 250 volt switch at Falk's Department Store, Boise, Idaho.

"When we checked the load on the switch we found that only 380 amperes were flowing. Even with this load the ordinary fuses used would melt and open every 30 to 90 days.

"The result of these fuse blows was confusion and annoyance to both customers and employees.

"At the suggestion of a local wholesaler's salesman 600 ampere 250 volt Fusetron dual-element Fuses were installed.

"The heating in the switch stopped immediately and we have not had that type of trouble since."

R. M. Alloway
Alloway Electric Co.,
Boise, Idaho.

One needless shutdown . . . one lost motor . . . one destroyed switch or panel . . . one burned out solenoid . . . may cost you far more than replacing every ordinary fuse with a FUSETRON dual-element fuse **now!**

FOR INFORMATION, MAIL THIS COUPON TODAY . .

BUSSMANN Mfg. Co. (Division of McGraw Electric Co.)
University at Jefferson, St. Louis 7, Mo.

Please send me complete facts about FUSETRON dual-element Fuses.

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*Title*_____

*Company*_____

*Address*_____

*City & Zone*_____ *State*_____ 853

with Fusetron Fuses

Here's why CORROSION COSTS YOU MORE than WROUGHT IRON

IT TAKES ONLY **ONE** TO INSTALL PIPE...

BUT **FIVE** TO REPAIR IT!

One of the most convincing demonstrations of the economy of using *durable* material is a pipe repair job where low-first-cost material has failed—and is being replaced.

The original installation had been quickly made by plumbers. But the replacement calls for hours of work by as many as five crafts: plumber, mason, plasterer, carpenter, painter. Often, maintenance is billed at overtime rates. And this is only part of the cost story. Production slow-down, disrupted routine may amount to far more than the maintenance charges.

Fortunately there's an answer to pipe durability in corrosive services—Byers Wrought Iron pipe. In literally thousands of applications where corrosion is a threat, the use of this material has proved the soundest kind of economy move.

The next time you specify or approve pipe, you'll find it profitable to investigate the durability records of wrought iron.

Our bulletin, "The ABC's of Wrought Iron," gives the what, why and where of this material. Write for a copy.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. Export Division: New York, New York.

Remember—
the pipe that lasts
the longest
costs the least!

FOR PRODUCTION CONTINUITY LOWER MAINTENANCE— Insist on Byers WROUGHT IRON PIPE

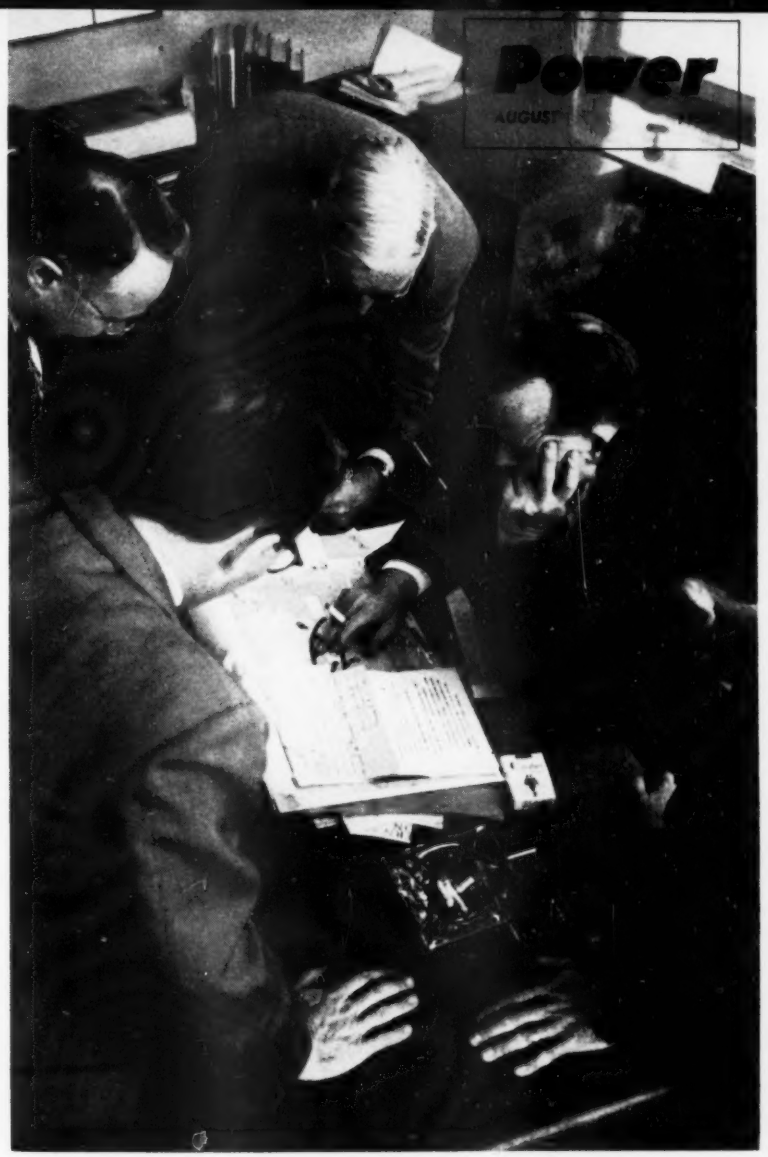
BYERS

CORROSION COSTS YOU MORE THAN WROUGHT IRON

WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS



You know

it pays,

but...

...Modernization has to be "sold"

And, all too often, there's the rub. Yet putting your ideas across to management isn't hard—just remember these points:

- **Show how power-service savings bring down cost of finished product and boost net profit**
- **Spot major elements of power-service cost, show what's happened to them and how modernization will reduce them**
- **Above all, sum up your key points in management's own language—charts and graphs, cost comparisons . . .**

To see how one modernization job was sold, turn page →

Story behind the story...

No one expected anything unusual when two Western Electric engineers presented a paper* on power-plant modernization at ASME's spring meeting. You could have predicted its nature—an analysis of the problem, a description of the new plant, a report of savings effected. And the paper did all that in an exceedingly workmanlike fashion. But so do many articles on modernization. What made this different?

Just one thing, we believe. The authors didn't stop when they'd figured out the answers. They knew they'd have to enlist active support of management. So they put real thought and imagination into "translating" their findings from Btu's and kwhr to management's own terms of costs, savings and profits. To top it off, they hit their key points hard with easy-reading charts and diagrams.

The result? Management listened understandingly, went along with the proposals. And we have a relatively rare case study in the art of "selling" engineering ideas to management.

We've freely adapted this paper, on these two pages and the two that follow. You'll find here the broad outline of the modernization problem and its solution. More important, we think, you'll find key examples of the way facts were interpreted in management terms. Use them to stimulate your own thinking when you have a modernization plan to put over with management.

Now for background: Hawthorne Works of Western Electric Co (Cicero, Ill.) is a major link in the manufacturing chain supplying the Bell Telephone System. Engineers there were fully aware of dollar savings a modernized power plant could produce. Yet they recognized that light manufacturing, characteristic of most Western Electric operations, grew up with a history of high ratios of manpower to heat-produced energy. This ratio once ran so high that energy cost had little effect on product cost.

But an undeniable change had taken place over the years. Use of more power per worker was making energy cost a vastly greater part of the total. And so Hawthorne's old power plant was exacting an ever greater toll in needless fuel and labor costs. The answer seemed obvious—call management's attention to the situation and take steps to correct it.

The engineers began by compiling data on past and probable future labor-energy ratios and the effect of energy cost on production. Next they isolated and traced the past experience of the two major influences on energy costs—fuel and labor.

They were then ready to work out new plant cycles that would cut these costs and do it in a way that offered quick recovery of capital expenditures.

Up to this point, they followed the thinking and methods typical of engineers. Then they took the extra step of translation to management terms which is emphasized in the remainder of this article.

These basic facts →

Pictured this way →

Produced these conclusions →

**Rehabilitation of an Industrial Power Plant*, by C E Morrow, Power & Service Facilities Engineer, and R F Born, Mechanical Engineer, Western Electric Co, Chicago, Ill. Paper No. 53-S-14, Spring Meeting, ASME, Columbus, Ohio.

More power per worker shows up as a decided trend in industry today. Light manufacturing is no exception. At Western Electric, the term "power" means manufacturing energy. It represents the heat equivalent of net plant output, including electricity, process steam, compressed air, building heating. But for graphical representation a single yardstick was desirable. Electric energy was chosen because more accurate data was available than for steam or other forms of energy.

Chart below dramatically pictures how electric energy and more efficient manufacturing methods have changed the ratio of manpower to energy. In 1929, with plant personnel up three times over 1910, plant operations took 14 times as much electrical energy. In 1951, employment was down to 55% of 1929, but electricity usage was up 11%.

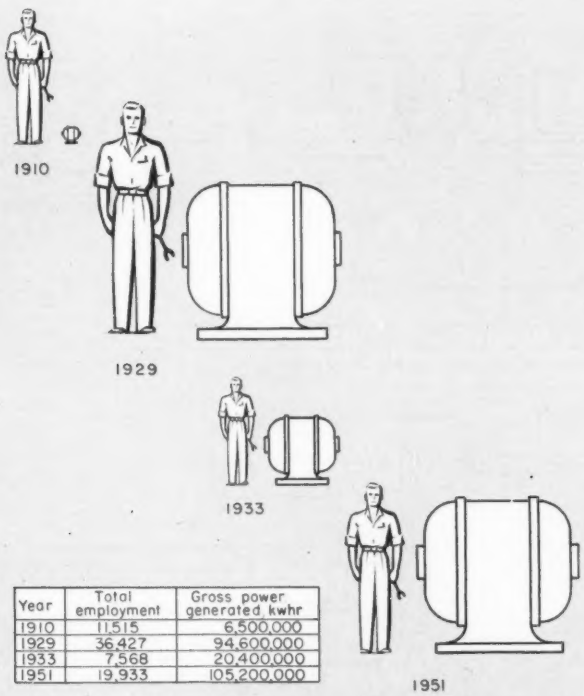
Other data collected in the study indicate similar relationships for steam and other forms of energy. Energy cost is now major factor in product cost—chart, studies below:

Fuel and labor are major elements in energy cost. Since 1914, both wages and coal costs tripled. You'd expect energy cost to increase in about this proportion unless energy-generation improvements compensated for increases.

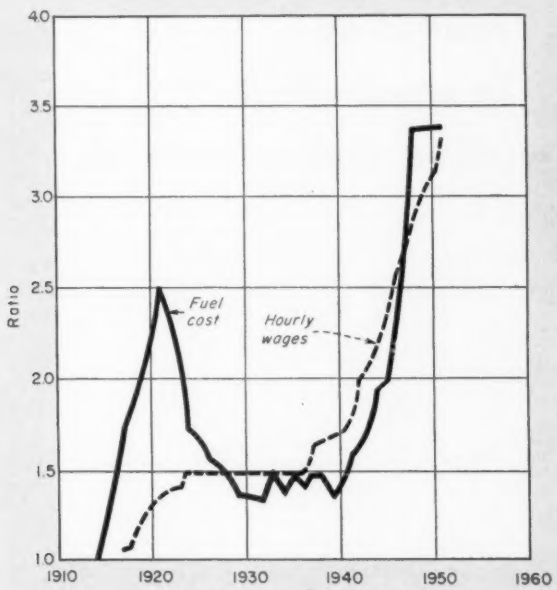
That's what happened at Western Electric. In 1928 they completed a power rehabilitation program based on a study made in 1926. This report, with its complete 1926 operating data, served as an ideal reference point for the 1949 survey.

Generation in 1926 was 52 million kwhr, compared with 94 million in 1949. But boiler output to produce this demand, plus other manufacturing energy, was about the same. This shows improvement in cycle efficiency over the period. But same amount of fuel was needed in 1949 as in 1926, so gains took place outside of the steam-generating equipment.

In 1949 coal costs ran 91% higher than in 1926 and labor was 186% higher. Variable cost per million Btu of manufacturing energy was up 64% by 1949.



Year	Total employment	Gross power generated, kwhr
1910	11,515	6,500,000
1929	36,427	94,600,000
1933	7,568	20,400,000
1951	19,933	105,200,000



Studies of growth in energy requirements indicated that, if trends established over a 25-yr period held true, normal production levels would produce maximum demands averaging 26,000 kw for the next ten years. Load factor would run over 50%. By 1960, maximum demands as high as 28,000 kw could be expected. While these figures received full attention, modernization plans were based on a conservative 23,000-kw maximum demand and 45% load factor.

Studies of process-steam needs revealed generally similar trends. Relationships were developed to permit making long-range estimates of steam demands.

These figures made it imperative to find ways to reduce costs. This investigation got under way in the latter part of 1949. In April, 1950, it was accelerated because insurance carriers said that the old boilers in the separate 26th Street plant had to be replaced in two years.

So total annual energy costs went under the microscope. Only unit cost considered was that per million Btu of manufacturing energy. Two alternatives were apparent: (1) Purchase all or part of electric energy from the utility. (2) Continue power generation but with a cycle improved to reduce fuel cost and with equipment needing minimum personnel.

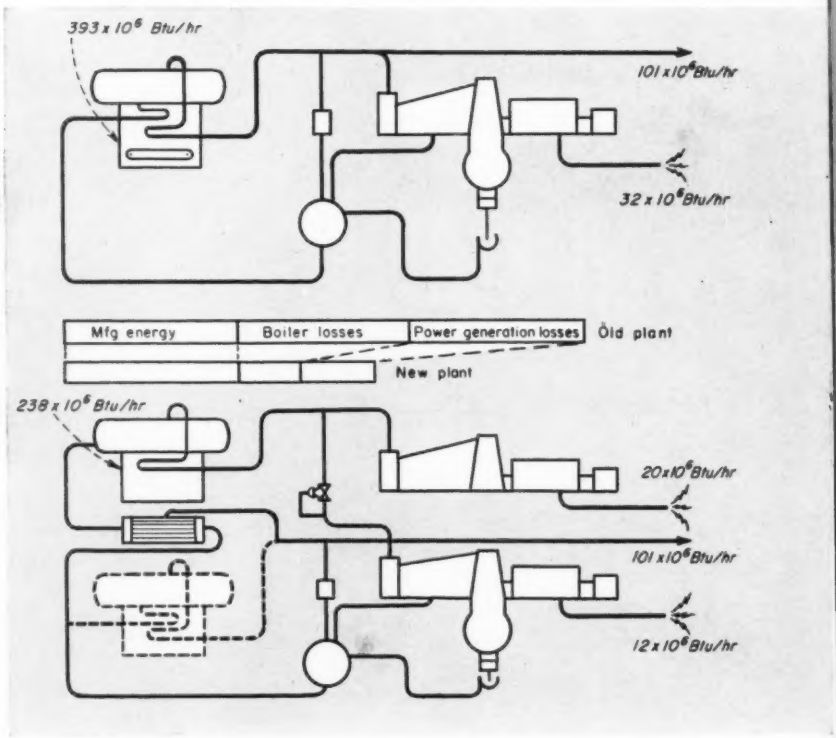
turn page

Thorough study of conditions

Heat-cycle studies were based on actual operating loads for 1949, on the theory that if a change were warranted for present loads it would be imperative for future needs. Electric consumption ran 94-million kwhr, with a peak demand of 23,000 kw. Together with other forms of manufacturing energy, this gave an average hourly demand of 133-million Btu. Existing plant cycle is shown in upper part of sketch below, simplified to combine 26th Street and main plants.

With this hookup, it took about 393-million Btu fuel input per hr to meet demand—a cycle efficiency of about 34%. Over-all steam-generating efficiency averaged 67%, so 216-million Btu per hr were available for manufacturing needs. Nearly two-thirds of this went directly to manufacture in the form of process and space heating, direct steam uses. The remaining third, 160-million Btu per hr, supplied 32-million Btu per hr equivalent of electric energy. Almost all the remainder of 128-million Btu per hr was lost to the condenser cooling water.

Pointed up in graphic style



Showed how modernization pays

Revised heat cycle (lower part of sketch) reduces one of the elements most affecting power cost—fuel. Here, the same manufacturing energy needs of 133-million Btu per hr are supplied by 238-million Btu per hr of fuel. Cycle efficiency of 56% nearly doubles the original 34%.

Bar charts between old and new cycle diagrams show steam generating losses cut by about 65% and losses charged to electrical generation just about halved.

A tie-in with the local utility would look good economically if it were possible to feed back excess energy when available. This the local utility would not consider.

Labor cost, the second major variable in power cost, was not, of course, directly affected by the new power cycle. But Western Electric engineers knew that equipment improvement made labor savings possible. They felt they owed management all the benefits new designs could deliver.

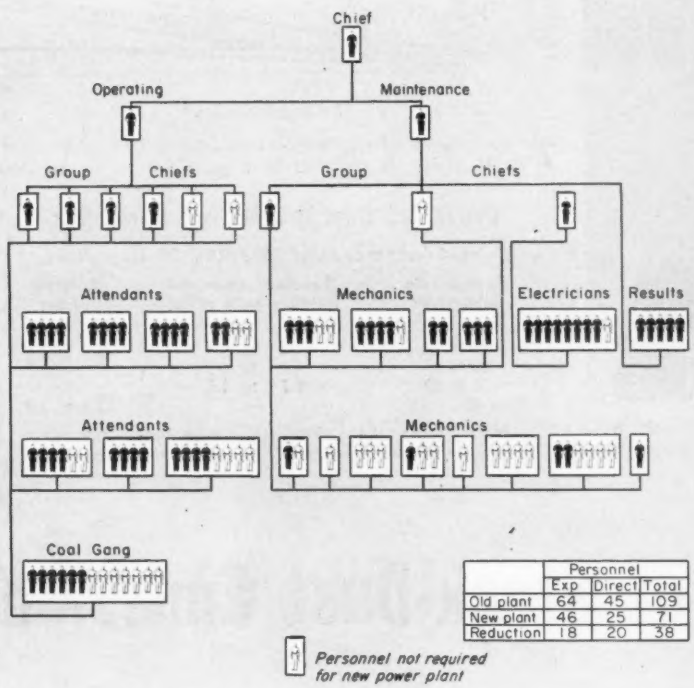
The boiler-room picture especially showed immediate opportunities for bringing labor costs down nearer those obtained with modern layouts. Maintenance costs were up to $0.068 per 1000 lb steam—against the usual $0.02 in up-to-date plants. Attendance personnel also ran high compared with equivalent units employing automatic control. Chart below shows personnel setup before and after modernization.

Studies of firing methods singled out pulverized coal as the choice for economical results with automatic control. What's more, it promised easy conversion to gas or liquid fuel whenever desired, which allows further economies as fuel prices change. This selection, plus shutting down 26th St plant, meant lower labor costs—chart, story below:

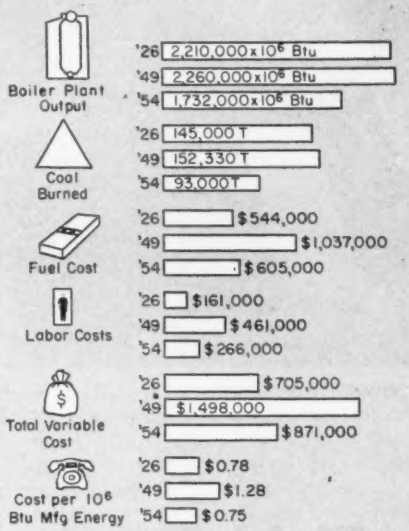
Complete cost and output comparisons must form part of any presentation to management. So the key years of 1926 and 1949, basis for comparisons in other parts of the investigation, were used for charting key factors. For comparison, estimated totals for 1954 were added. This is the first year all new equipment will be running, all old gone.

Improved cycle efficiency promises a reduction in steam input of 19%. This, together with higher steam-generating efficiency, brings fuel consumption down by 39%. Allowing one cent per million Btu saving in coal purchase price because of wider selection possible with new equipment, this means total coal-bill savings of $432,000 annually.

With maintenance and operating costs reduced by some $195,000, annual saving in variable operating cost amounts to $627,000. From this must be deducted fixed charges on the $5,017,000 of new capital investment. So net annual operating savings become $432,000. Unit cost per million Btu of manufacturing energy shows a 41% reduction.



	Personnel		
	Exp	Direct	Total
Old plant	64	45	109
New plant	46	25	71
Reduction	18	20	38



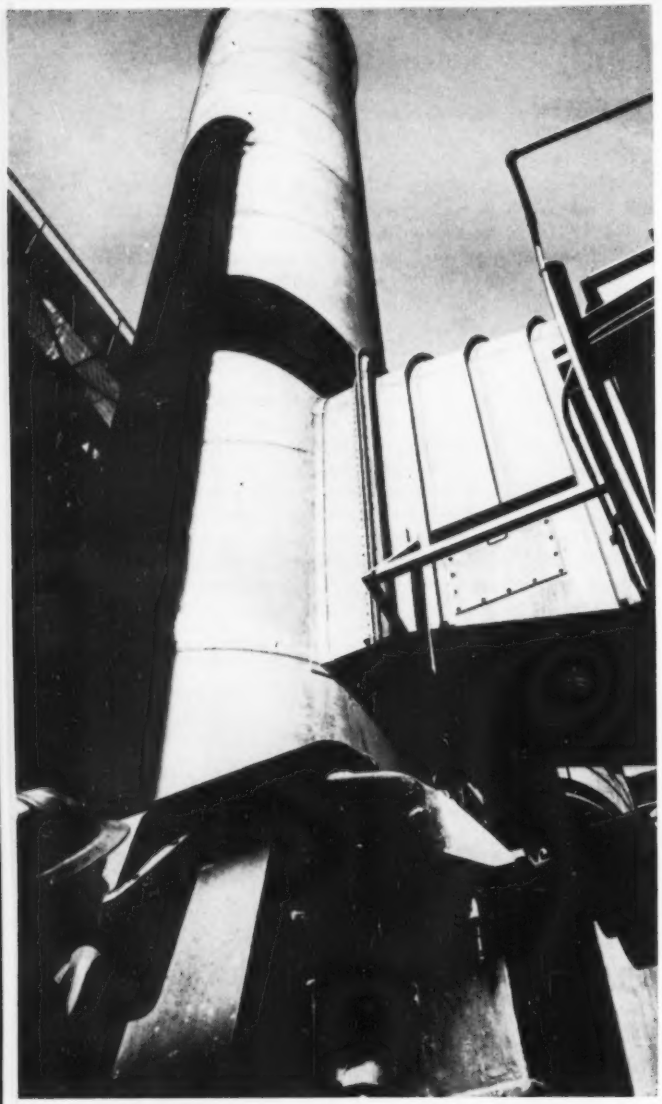
Year	Annual electric power consumption million kwh	Max dem kw	Load factor %
1926	52	15,200	39.5
1949	94	23,000	45.0
1954	94	23,000	45.0

Careful equipment selection and installation promised to cut outage time and maintenance cost. Further, the problem of getting personnel to handle dirty and dull jobs connected with old-style fuel and ash handling largely disappeared. New equipment permitted better operating routine with fewer jobs but attracted personnel of higher caliber.

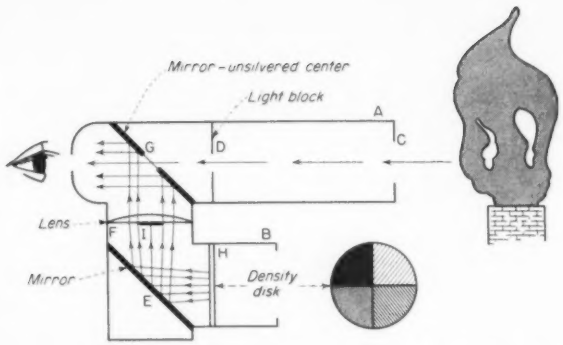
Table at bottom of chart above shows over-all reduction in personnel possible with the new layout and how it affects operating and maintenance forces, classified respectively as expense and indirect. Maintenance shows a somewhat greater drop—a total reduction of about 38%.

Basis for original study was a production level equivalent to 23,000-kw maximum demand and 45% load factor. At last report, demand was 26,000 kw with 48% load factor. This higher demand increases annual savings possible with the new equipment. Actual experience at higher demand levels indicates that annual savings after fixed charges come to $510,000, against the estimated $432,000.

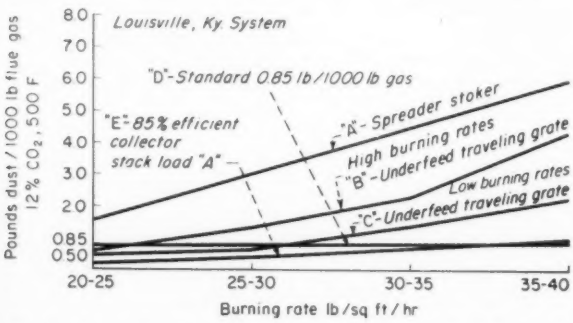
Over and above this are some sizable savings resulting from speeding new-plant construction. Cutting schedule from 5 to 2½ yr brings immediate saving in contractors' overhead plus $904,000 return from realizing operating savings earlier.



POWER-PLANT STACK and connecting breeching usually have no facilities for proper sampling and testing of stack gases



1 Special instrument, a Smokescope, places stack discharge, seen through apertures, in center of reference density disk



2 Stack-dust loadings, based on the Bituminous Coal Research table, *below*, is designed as a guide for boiler operators

Dust in Stack Gases by Stoker Type, Burning Rate

Grains of dust per cu ft gas, 500 F; 12% CO_2 leaving boiler

Burning rate lb/sq ft/hr	*Underfeed, chain and traveling-grate stoker*	*Spreader stoker*
20 to 25	0.15 to 0.2	
25 to 30	0.2 to 0.4	
30 to 35	0.4 to 0.7	0.5 to 1.8
35 to 40	0.7 to 1.3	
Over 40	—	1.8 to 3.0

Note: To convert the above values to pounds of dust per 1000 lb of gas adjusted to 12% CO_2 multiply by 3.30.

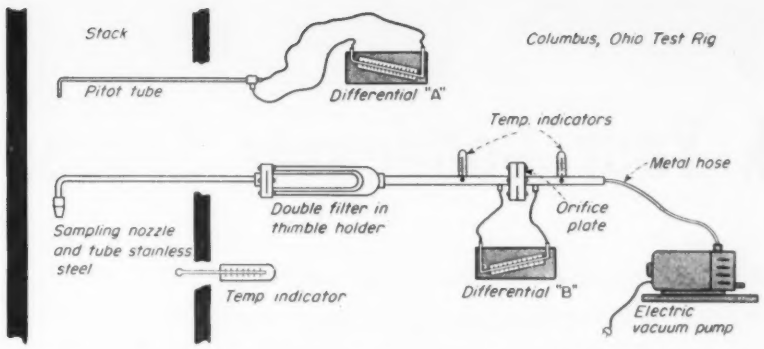
Field Testing of Stack-Dust Emission

Determining just when a plant stack goes beyond allowable air-pollution ordinances is a tough job for enforcement as well as plant men. Here are some of the latest field aids employed around the country for combatting this problem

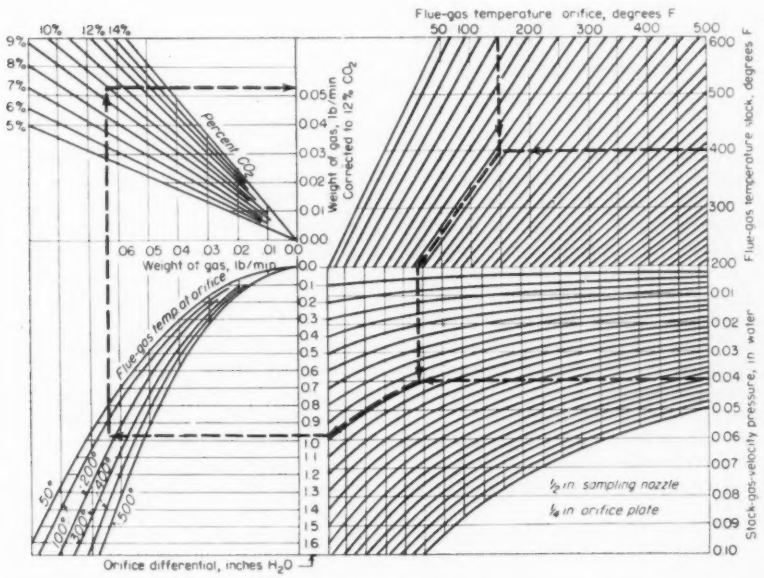
► IN RECENT YEARS, air-pollution control has been getting unusual attention in a large percentage of our industrial areas. Along with it has come legislation frequently spelling out allowable limits for smoke emission, either in density to the eye or in actual stack-dust loading. But, unfortunately, the accepted methods of measuring these discharges do not lend themselves to simple, indisputable checks that plant operators or enforcement agents can run.

As a direct, practical result of this measuring weakness, air-pollution control suffers. You'll find enforcement ordinances vary all over the lot in the way they identify a stack offense. Some employ the long used Ringelmann chart to decide density, and let it go at that; others refer to the ASME Power Test Code for dust loading.

The Ringelmann chart, for example, has been shot full of holes because there are so many outside influences that bear on its readings. For example, the background against which the stack is compared, the lighting variations, the observer's position, whether the day is



3 Stack samples, carried out by one Midwestern smoke-regulation department with this test equipment, are given a quick on-the-spot check with curves in 4, below


Flue-gas temperature orifice, degrees F
Percent CO2
Weight of gas, lb/min Corrected to 12% CO2
Weight of gas, lb/min
Flue-gas temp at orifice
Flue-gas temperature stack, degrees F
Stack-gas-velocity pressure, in water
½ in. sampling nozzle
¼ in. orifice plate
Orifice differential, inches H2O

4 Chart permits a field appraisal of stack loading for smoke-control purposes and translates results as being within or either side of the allowable limits

Needs Simplifying

bright or dull, the more than likely differences in light intensity on the chart as contrasted with that at the stack—all contribute to the doubts about the value of the Ringelmann.

The ASME Power Test Code, designed primarily for performance and acceptability tests of dust collectors, proves a very trying method of field testing for allowable stack-dust loading.

Many directly involved in smoke-control work have been pushing to uncover suitable yet easily applied stack-measuring devices. Along with these individual efforts there is a well-integrated test-code activity, sponsored by the ASTM Committee D-22 and numbering some 60 technical experts. Out of their efforts may very well come the truly scientific means of properly evaluating stack discharge. Possibly they may even be able to convince the public as well as the enforcement agent that visible stack emission is no true measure of an individual stack's contribution to a city's dust-fall problem.

Density Measurements. In the meantime, though, new developments in the field of stack-dust measurement are being introduced. Fig. 1 pictures the operation of the Smokescope, as presented by J P Strange of the Mine Safety Appliances Co before the spring meeting of American Society of Mechanical Engineers in Columbus, Ohio. It is aimed at removing criticisms to the Ringelmann method of measuring stack density. A reference-standard film disk *H* is viewed against the background next to the stack. Both smoke and reference film get light from the same source.

Then a lens in the instrument projects a virtual image of the reference standard to a focal distance equivalent to that of the stack. Then the eye can make of truly realistic comparison. This system limits the field of vision to the stack area and eliminates stray light.

Light from the area next to the stack passes through the reference film disk *H*, in the barrel *B*, to front-surface mirror *E*. This mirror, together with the lens *F*, places an image of the reference film on the image mirror, where you can compare it with the smoke as you see it through the apertures. The four densities corresponding to Ringelmann numbers 1-4 appear on the image mirror.

Stack-Dust Loading. Fig. 3 is a special testing arrangement developed by H C Ballman and his staff in the Smoke Regulation Dept of Columbus, Ohio. They estimate it takes a crew of two to three men two days to run a set of tests they can use in smoke-control work. The charts, Fig. 4, permit them to translate field data from the test setup directly to usable results right on the job.

The usable results Ballman seeks are whether an individual stack-emission rate lies within or without the ordinance allowance, namely 0.85 lb per 1000 lb of flue gas. In fact, a reasonable margin of 0.15 lb, or roughly 17.5%, is permitted so that if a stack tests out at 0.85 lb per 1000 lb of gas or under it's approved; between 0.85 and 1.0 lb per 1000 lb, it's approved based on duplicate tests; over 1.0 lb per 1000 lb, and it's disapproved. The only flaw Ballman finds is that few plants have reasonably long, straight runs of duct so vital to accurate dust-load sampling.

Down in Louisville, Ky., J C Marks, assistant chief, and R W Bourne, chief engineer of Jefferson County Air-Pollution Control District, have worked up the chart in Fig. 2, based on the table (facing page) from Bituminous Coal Research publication, *Aid to Industry, 500-320.* This chart's sole objective is to acquaint the plant-operating man with the amount of dust he is sending out his stack under various firing rates, and how these amounts compare with the ordinance recommendation, Fig. 2, line *D*. The rest is up to the operator.

How to Check Your Condenser Losses

That big, silent heat exchanger hanging on your turbine exhaust can be in trouble without showing visible signs of distress. Here are some nomograms that will speed up the job of making adequate routine checks on your condenser performance

By F B PYLE, *Production Engineer Analyst*
Ohio Edison Company

► WHEN A CONDENSER does not work properly, we can take corrective action only when we know what causes the loss in vacuum. This approach to the study of condenser performance has been used for many years at some Ohio Edison Co plants. It is based on formulation of empirical standards by testing each condenser. C D Zimmerman, production operations engineer, initiated this system some years ago. Series of curves were developed to indicate vacuum loss from: (1) dirty tubes (2) low circulating-water flow (3) excessive air leakage.

To extend this method of checking to other plants on the system the nomograms, pp 79-81, have been developed. They apply to any condenser and reduce the amount of testing needed to establish standards. They also simplify the calculations.

Condenser Cleanliness. Heat Exchange Institute Standards specify methods of correcting for circulating-water temperature, steam loading and circulating-water velocity. The generally accepted method is given in *Standards of Heat Exchange Institute* —"Condenser Section," available from the Heat Exchange Institute, 122 East 42nd St. New York, N. Y., $1 per copy. While these standards are valuable in specifying new units, 100% cleanliness, based on these standards, often does not coincide with 100% commercial cleanliness on a given condenser. Older designs with poor steam distribution can't make 100% under best conditions. Some modern units, however, consistently achieve 130% because of better laning.

Chart 1—"Condenser Cleanliness"—simplifies figuring a true cleanliness factor expressed as a percentage of the heat transfer actually obtained on a given condenser under clean conditions. If you know (1) actual heat transfer by testing (2) theoretical heat transfer from HEI Standards for same temperature, steam loading, circulating-water velocity (3) heat transfer obtainable *under clean conditions* based on HEI Standards, you can calculate the actual cleanliness expressed as a percentage of the heat transfer obtainable with the same circulation-water velocity.

Loss From Dirty Tubes. Using the true percent cleanliness and Chart 2, you quickly find the vacuum loss from dirty tubes.

Loss From Low Cooling-Water Flow. The vacuum loss from low gpm is found on Chart 2 by using ratio of design (or test) gpm to the gpm found when checking condenser. Normal causes of low gpm include: (1) tube-sheet fouling (2) screen plugging (3) worn pump impellers. Tube-sheet fouling may also indicate an additional loss as dirty tubes, even though the tubes are relatively clean. This is caused by reduction of effective condenser surface when tubes become plugged. Cleaning the tube sheet eliminates this loss automatically.

Excess Air-Leakage Loss. Chart 3 figures the loss from excessive air leakage. Loss is (1) proportional to the relative partial pressure of air in the steam-air mixture (2) larger than that from partial pressure alone because of blanketing effect variations. One test is needed to determine the constant C, which takes care of the blanketing effect.

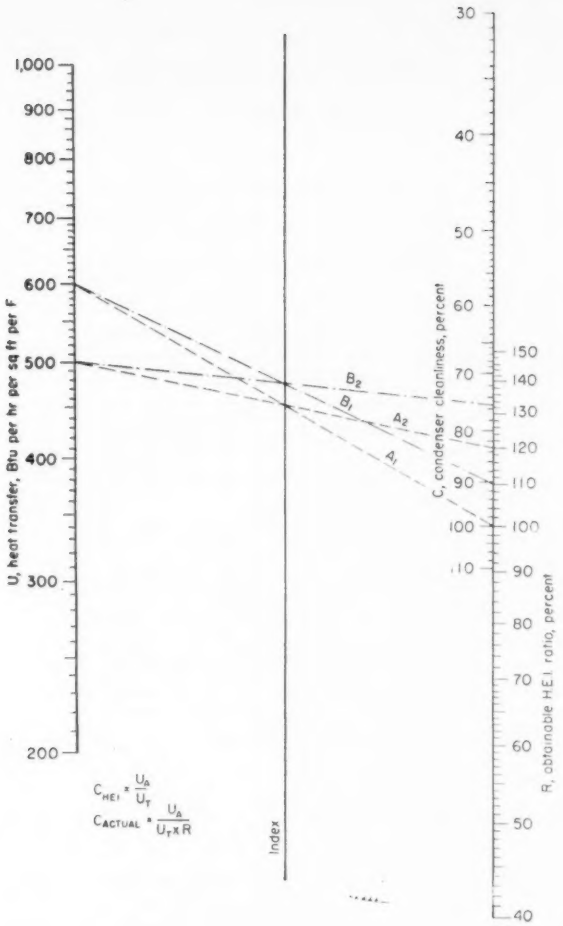
Best method of running such a test allows air to bleed into the condenser through an orifice designed for, say, 5 cfm. Excessive air leakage can also be checked on the meter normally used in conjunction with the air ejectors.

The air-leakage constant C is found by calculating backward on Chart 3, using (1) the difference between backpressure before bleeding and backpressure bleeding as the loss (2) the known additional air leakage bled into the condenser. This value of C can be used in subsequent checks.

Deficient Air-Removal Capacity. Although no chart is included to check on this loss let's discuss it briefly. As backpressure falls, the specific volume of air grows. If air ejectors are undersized or not operating properly, they may not be able to handle normal air leakage at low backpressures. In this case, backpressure will increase above that which heat transfer could hold to an equilibrium condition at which the air ejectors can remove air leakage. If condenser performance falls off sharply at high vacuums but returns to normal when the load or circulating-water temperature raises the backpressure, deficient air-removal capacity should be suspected and checked at the earliest opportunity.

Over-all Performance Factor. Chart No. 4, p 80, gives the over-all performance factor for a condenser expressed as a percentage of the heat transfer obtainable for standard cleanliness, gpm and air leakage. Keeping an eye on this factor from week to week quickly shows when a condenser needs to be investigated for maintenance needs.

Cost of Loss. Chart 5 calculates total plant-input increase caused by total vacuum loss. This chart includes the effect on turbine-exhaust loss as shown by the graph at start of chart. Dollar value of the total loss helps in deciding how far maintenance activities should go in trying to correct below-standard conditions in the condenser.



1: Condenser Cleanliness

A. To calculate cleanliness based on Heat Exchange Institute Standards:

1. Connect actual heat transfer, found on performance check, with 100% on cleanliness scale.

2. Draw a line between the theoretical heat transfer (based on HEI Standards) and the intersection of line (1) and the index, extending across the cleanliness scale; read percent cleanliness based on HEI Standards.

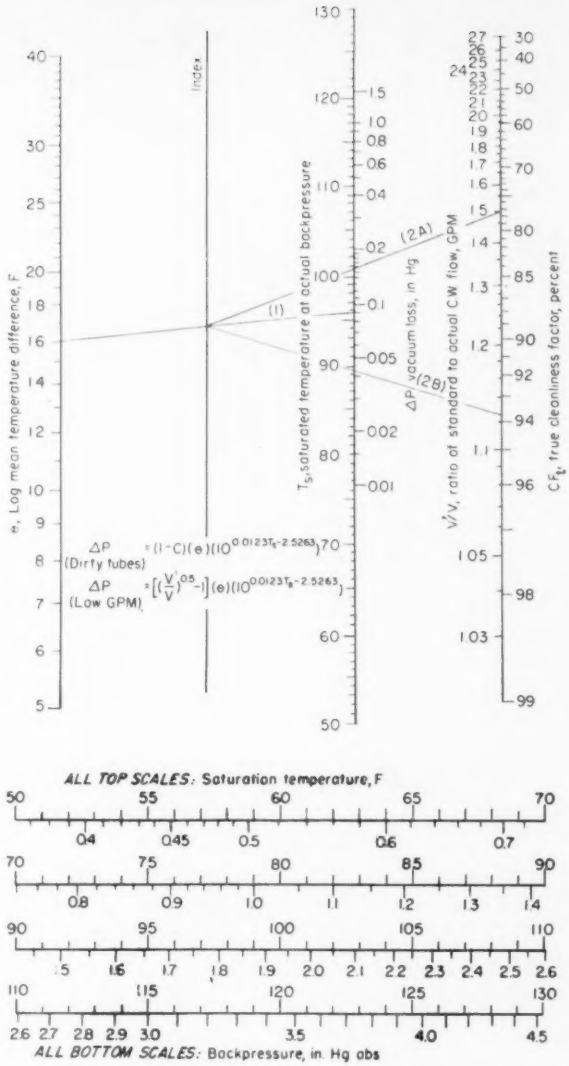
Example: $U_t = 600$, $U_s = 500$. Connect 600 on heat-transfer scale with 100 on cleanliness scale. Extend line *A-2* from 500 through intersection of *A-1* with the index. Read cleanliness (HEI) = 83.3% on cleanliness scale.

B. To calculate true condenser cleanliness for a given unit:

1. Draw a line connecting the theoretical heat transfer with the obtainable HEI ratio.

2. Draw a line connecting the actual heat transfer and the intersection of (1) and the index; read cleanliness percent.

Example: Condenser, in example above, normally tests 110% based on HEI Standards when tubes are clean. $R = 110$. Draw *B-1* connecting 600 with 110 on *R* scale. Connect 500 with intersection of *B-1* and the index; read 75.7% from the intersection of *B-2* and *C* scale.



2: Vacuum Loss From (a) Dirty Tubes (b) Low Circulating-Water Flow

Vacuum Loss From Dirty Tubes.

1. Draw a line connecting the log mean-temperature difference with the saturation temperature corresponding to the condenser backpressure (see adjacent scales in lower part of chart).

2. Draw a line from intersection of line (1) with the index to the true cleanliness, read vacuum loss in in. Hg.

Example: LMTD = 16.0, backpressure = 1.71 in. Hg, $T_s = 96.0$ F, $CF_t = 77.2\%$, vacuum loss = 0.16 in. Hg.

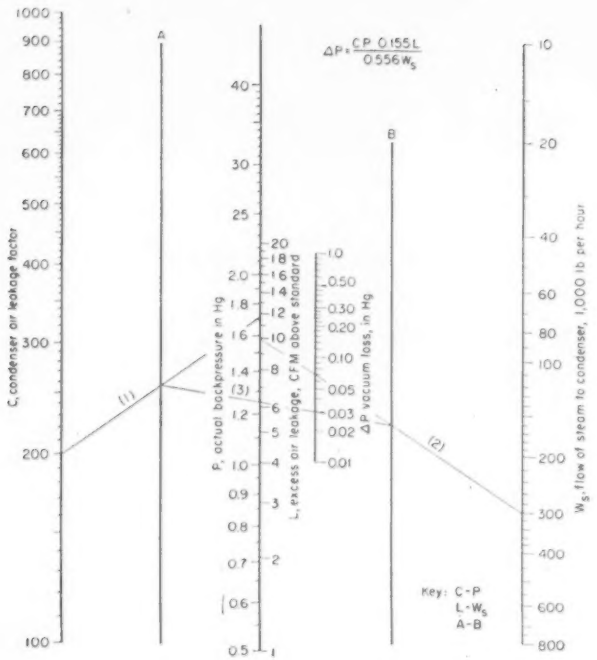
Loss From Low Circulating-Water Flow.

1. Draw line (1) as above.

2. Draw a line from intersection of line (1) with index to the V'/V scale (ratio of standard or design gpm to actual gpm); read vacuum loss in in. Hg.

Example: $V' = 45{,}000$ gpm, $V = 40{,}000$ gpm, $V'/V = 45{,}000/40{,}000 = 1.125$, loss = 0.04 in. Hg.

(*Continued on page* 80)



3: Vacuum Loss From Excessive Air Leakage

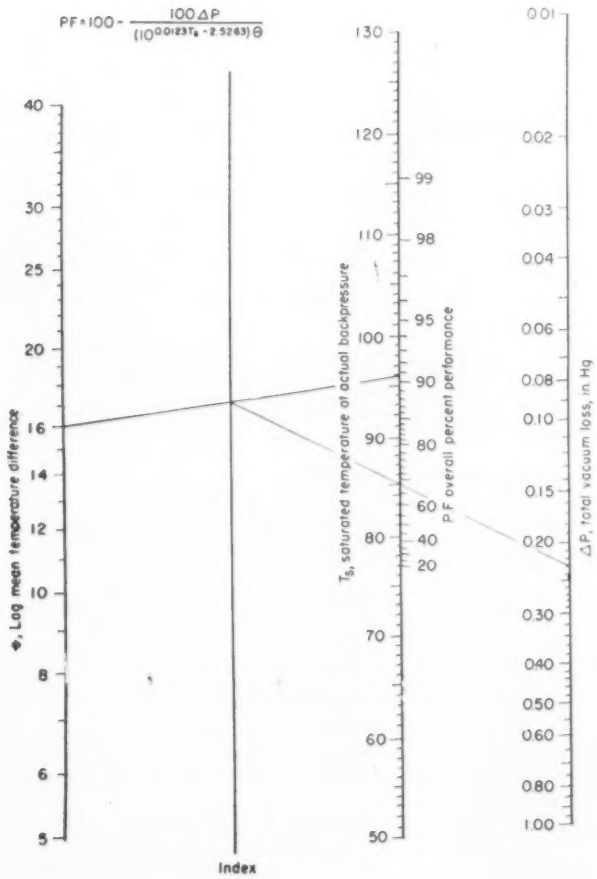
1. Draw a line connecting the air-leakage constant C for the condenser with the actual backpressure P.

2. Draw a line connecting the amount of air leakage in excess of standard L with the condensate flow W_s.

3. Connect the intersection of lines (1) and (2) with A and B; read ΔP, the loss is in. Hg.

Example: P = 1.71 in. Hg, C = 200, air leakage = 15.0 cfm, standard leakage = 5 cfm, excess leakage = 10.0 cfm, W_s = 300,000 lb per hr, ΔP = 0.03 in. Hg.

To determine air-leakage constant C with other conditions stabilized, bleed a quantity of air into the condenser. Using the excess leakage L (as measured by the air-removal meter) and P_2, the actual backpressure after bleeding (then $P = P_2 - P_1$) and the steam flow, solve backward for C. Check C at several loads to determine extent blanketing varies with load.

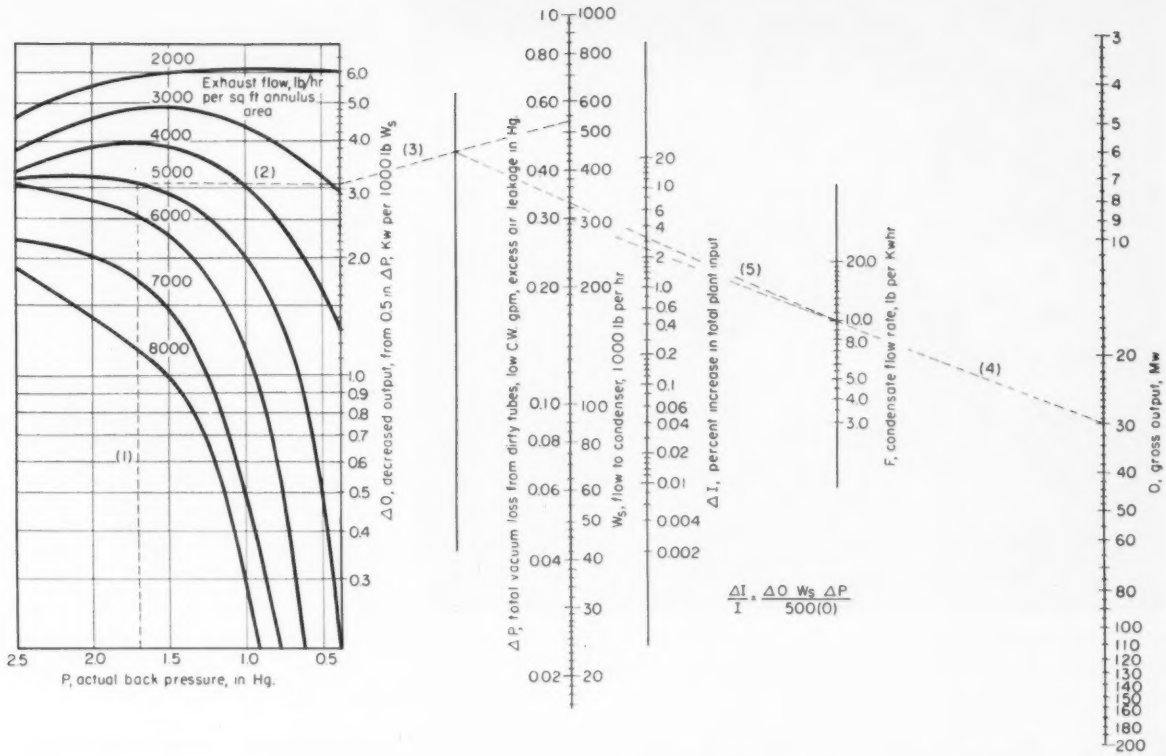

$PF = 100 - \frac{100\Delta P}{(10^{0.0123T_s} - 2.5263)\theta}$
θ, Log mean temperature difference
T_s, saturated temperature at actual backpressure
P.F overall percent performance
ΔP, total vacuum loss, in Hg
Index

4: Condenser Over-all Performance Factor, Percent

1. Draw a line connecting θ, log mean-temperature difference with T_s, saturation temperature corresponding to actual backpressure (see Chart 1 adjacent scales for relationship).

2. Draw a line connecting intersection of line (1) with index with the total pressure loss ΔP, and read performance factor, percent.

Example: T_s = 96 F, $LMTD$ = 16 F, cleanliness = 77.2%, loss due to dirty tubes = 0.16 in. Hg, low gpm = 0.04 in. Hg, excess air leakage = 0.03 in. Hg. Total ΔP = 0.23 in. Hg, performance factor = 68.0%.


Exhaust flow, lb/hr per sq ft annulus area
2000
3000
4000
5000
6000
7000
8000
(1)
(2)
(3)
(4)
(5)
ΔO, decreased output, from 0.5 in ΔP, Kw per 1000 lb Ws
P, actual back pressure, in Hg.
ΔP, total vacuum loss from dirty tubes, low C.W. gpm, excess air leakage in Hg
Ws, flow to condenser, 1000 lb per hr
ΔI, percent increase in total plant input
F, condensate flow rate, lb per Kwhr
O, gross output, Mw
ΔI / I = ΔO Ws ΔP / 500(O)

5: Plant Input Increase From Loss of Condenser Vacuum

1. Find actual backpressure P on horizontal scale.
2. Read up to unit exhaust-flow curve, then horizontally to decreased output scale, ΔO, line (2).
3. Draw line (3) from ΔO to vacuum loss ΔP, in. Hg abs.
4. Draw line (4) from condenser flow W_s to gross output O.
5. Connect intersection, of line (3) with index, with the intersection of line (4) with F, the condensate flow rate.
6. Read ΔI on vertical scale, percent increase in input.

Example: $P = 1.71$ in. Hg, total vacuum loss $\Delta P = 0.53$ in. Hg, $W_s = 300{,}000$ lb per hr, $O = 30{,}000$ kw, exhaust annulus $= 60$ sq ft, exhaust flow rate $= 300{,}000/60 = 5000$ lb per hr per sq ft, $\Delta O = 3.1$, $F = 10$ lb per kwhr, $\Delta I = 3.2\%$.

Central Station Capability Grows to New Highs

► Electric Power Survey Committee of the Edison Electric Institute, in their *13th Semi-Annual Electric Power Survey*, report that they expect the national station capability of 81,400,000 kw as of Dec 1952 to grow to about 125,500,000 kw in 1956. This growth of 44,100,000 kw is 54% of the 1952 capability to take place in a 4-year period. The trend continues to exceed past growth rates in the industry.

The report includes figures on the nameplate capacity, scheduled to be installed during the next four years, as of April 1, 1953. On the average, capability exceeds nameplate rating by about 15%. For steam turbines, 4000 kw and larger, annual figures are:

1953	151 units	9,682,000 kw
1954	125 units	10,018,000 kw
1955	71 units	7,800,000 kw
1956	35 units	3,757,000 kw

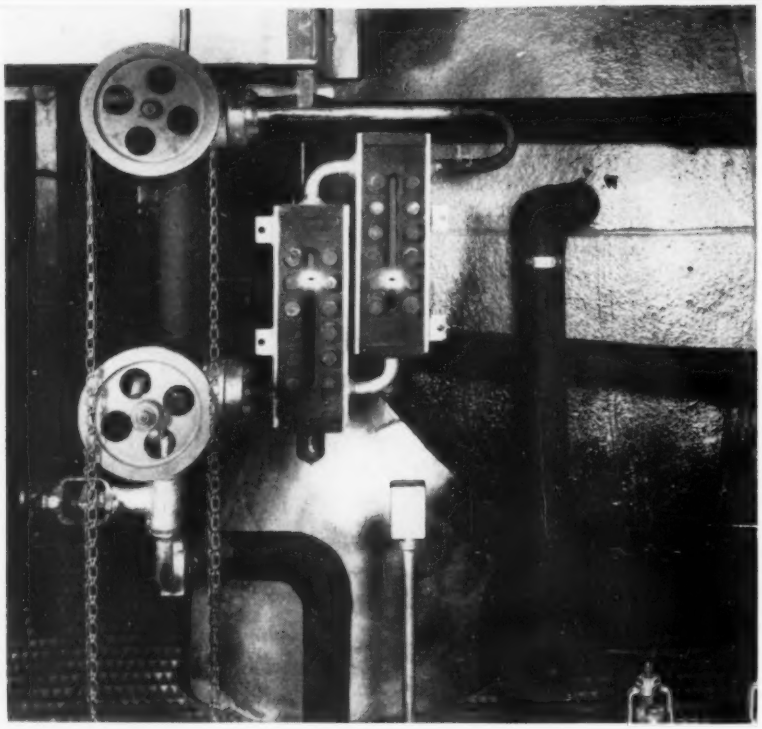
For hydraulic units, 4000 kw and larger, the annual figures are:

1953	64 units	1,924,000 kw
1954	37 units	1,063,000 kw
1955	41 units	1,584,000 kw
1956	12 units	458,000 kw

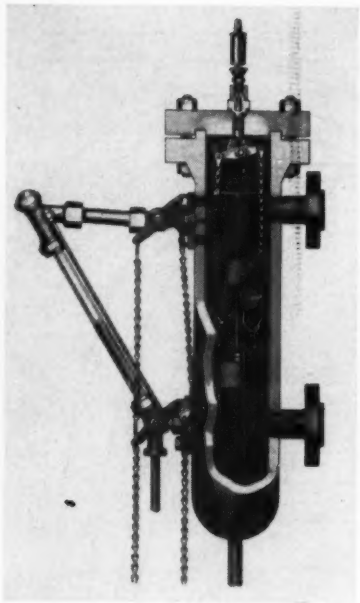
Combining the two types of units, we get the following annual figures on total nameplate rating for units 4000 kw and larger:

1953	215 units	11,606,000 kw
1954	162 units	11,081,000 kw
1955	112 units	9,384,000 kw
1956	47 units	4,215,000 kw

The gross margin of capability reserve in 1952 for the country as a whole was 11.7%. The indicated gross margin for 1953 is 14.6%, and for 1954 it is 16.2%. These percentages assume scheduled capacity will be added as listed. But the committee feels that all scheduled installations won't be completed as expected.



SEPARATED-DESIGN gage on No. 4 boiler, a high-pressure high-temperature unit in the Riverside Station, Consolidated Gas, Electric Light & Power Co, Baltimore, Md.



1 Floatless high-low alarm column with inclined water gage, used to 400 psi

For Greater Safety, Best Control, Pick Right Boiler Water-Level Gage

Good liquid-level indicating equipment, properly chosen and applied is one important key to best performance. Here are guides to unit choice, use

By FRANK PTACEK
Mechanical Engineer, Yarnall-Waring Co

► So far as safe boiler operation is concerned, water gages are about the most vital pieces of equipment in a boiler room. This is particularly true where operating pressure is high.

Primary function of a water gage is to give uninterrupted and reliable means of checking water level so no danger develops from extreme variations. Serious trouble can result from either high or low water level, though the low usually does the most damage.

In some boilers, only a few inches variation in water level can lead to serious consequences. Operator must promptly detect any variations in drum level so necessary changes in feed-control system can be made to restore level to desired point and keep it there.

Water-storage capacity in a steam generator is small compared with normal output in pounds per hour. So a close balance between feed and steaming rate must always be maintained. Knowing water level at all times prevents danger of extremely low water or a costly high-water carryover. Part of ASME *Boiler Construction Code*, "Suggested Rules for Care of Power Boilers," emphasizes the importance of the water-level gage. Get a copy of this section of the code if you don't have it.

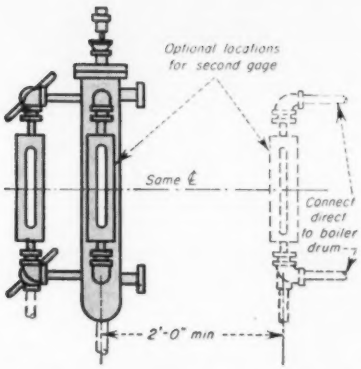
Pressure Range. Up to 350 psi, one tubular gage glass is suitable. This may be connected directly to drum or, as is more often the case, to a water column attached to drum. Water column (1) acts as settling chamber to steady water agitation (2) gives immediate warning of dangerously high or low water level when fitted with an alarm (3) has gage or trycocks for test purposes. Fig. 1 shows a typical assembly.

Above 400 psi, boiler should have two water gages of steel-enclosed type with flat glasses. Gages may attach to one water column or directly to drum. Fig. 2 shows typical installation for pressures above 400 psi.

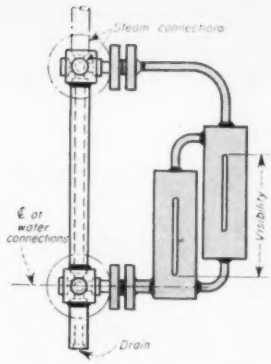
Above 600 psi there is a tendency to eliminate the water column and substitute a circulating tiebar, whose primary purpose is to connect the gages and reduce circulation through them. It keeps gage hotter, giving a truer indication of drum level than otherwise. An assembly for 2500 psi is shown in Fig. 3.

Installation Tips. With or without a water column, round or flat gages give the operator a simple "window" for observing drum level. When any other device or instrument fails, the water gage can be regarded as a "safe" device for showing drum level.

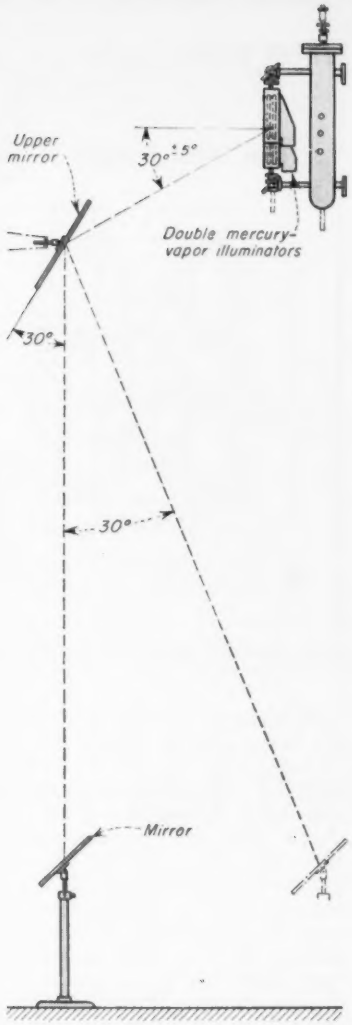
Be careful when designing gage installation. Here are some suggestions you'll find helpful in your planning. (1) Install gage as close to drum as possible, preferably on boiler nozzle.



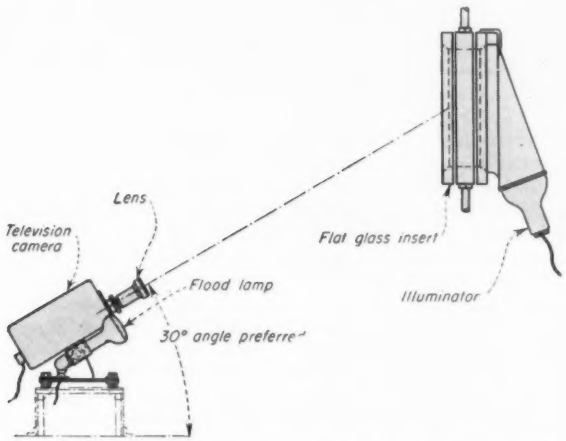
2 Optional locations for second water gage when pressure is above 400 psi



3 Twin gage assembly for 2500 psi. The circulating tiebar replaces column



5 Mirror arrangement used where total reflection distance is up to 125 ft

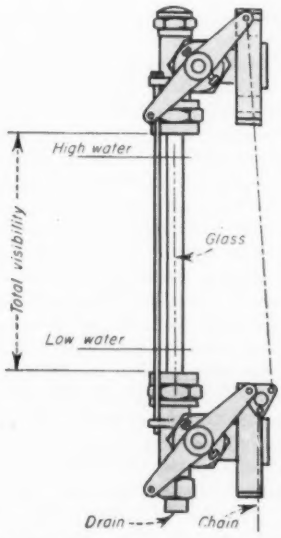


4 Typical arrangement for televising boiler-water level. Exact arrangement used depends on the distance involved

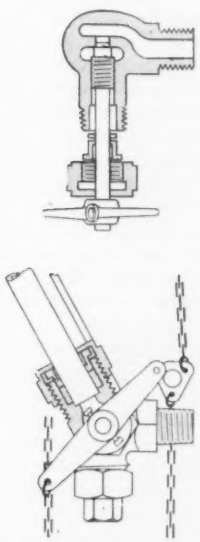
This minimizes water-temperature drop at gage glass, assures greater accuracy.

(2) Pitch steam connection toward gage. Condensate flowing into gage keeps it hotter. Pitch water connection toward drum to prevent formation of a cold-water pocket. (3) Top of visible portion of insert should be lower than steam connection to it, while lower visible portion of insert must be higher than water connection to it.

(4) Provide cleanout plugs at all right-angle turns where crosses are used. (5) Don't make any connections to gage piping, except where no flow of steam or water is needed. (6) Fit gage with suitable drain. (7) Present experience shows lower gage connection to drum should be insulated to keep gage at maximum temperature. Upper connection should not be insulated so maximum steam condensation occurs to promote circulation through gage.

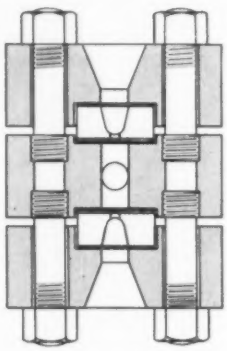


6 Vertical tubular gage glass used on low-height boilers with direct view

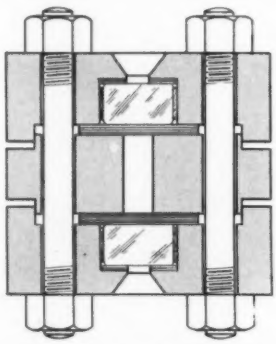


7 Bronze gage valves, chain-operated, for a typical 350-psi inclined gage

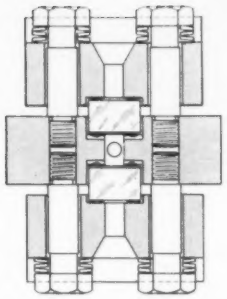
Two Other Designs of High-Pressure Water-Level Gages



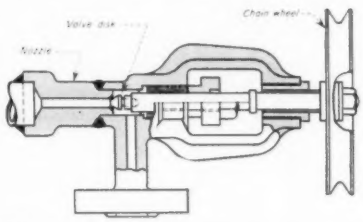
8 Mica inserts in this gage for 2000 psi won't break, blow out



9 Loose-window clear-glass gage. For working press. to 3000 psi



10 Mica, 0.015 in. thick, protects glass in this gage designed for 2500 psi



11 One-piece high-pressure water-gage valve for 1500-2500 psi pressures

Illumination. Tubular gage glasses are often used on boilers with low or moderate height. Usually it is unnecessary to provide special illumination. When required, one or two well-placed bull's-eye illuminators suffice.

For high-pressure boilers, clear and positive gage illumination is a must. One recent type uses a 100-watt mercury-vapor lamp in place of the usual incandescent. Meniscus shows up as a brilliant starlike line over the entire range of insert visibility. This is important for direct viewing, but even more so where mirrors are needed.

Interferences. Where beams, columns and other structural parts interfere with gage observation, a system of mirrors, Fig. 5, may be necessary. By using a light shield at gage and enclosing reflecting system in ducts, level may be transmitted over distances exceeding 125 ft. Lower mirror, on floor stand, may be some distance from boiler front. It is swiveled, has vertical adjustment.

While a simple mirror system costs least for transmitting gage reading to operator, mirrors may become dusty, break or require adjustment. Wired television, a recent development, overcomes these troubles and has many other advantages.

Televising Gage Level. Typical installation, Fig. 4, shows how industrial television camera is placed with respect to water gage. Distance between camera and viewing screen may be as great as 500 ft, with screen located where it will be of maximum use. This is usually on the operating or control panel.

Camera is light and rugged. In several installations, tube has never been replaced after months of service.

Where distance between camera and screen is greater than 500 ft, auxiliary viewers may be used. With coaxial cable, maximum distance increases to 4000 ft. For greater distances, amplifiers or a microwave transmitter, or both, may be used. See "TV Sees Where You Can't Look," POWER, April, pp 78-83.

Gage Uses. Typical practices in applying modern gages are as follows:

Vertical tubular glass finds use below 400 psi for low-height boilers. Viewing is direct; manufacturers are steadily improving glass life.

Inclined round glass, Fig. 1, is suitable for higher boilers at pressures to a maximum of 350 psi. Operator directly views an area of the meniscus. Top connection slopes toward column, prevents glass erosion by causing condensate to flow back into water column. Fig. 7 shows gage valves used.

Mica insert, Fig. 8, is held by a forged-steel body. Two windows of selected mica are securely held under slotted cover plates fastened by bolted clamps. For pressures to 2000 psi, mica segments are 0.035 in. thick. Mica is said to be a flexible material that bends but will not break or blow out when properly assembled. No glass is used in this type gage.

Loose-window clear-glass gage is suitable for pressures to 3000 psi, has patented construction. Instead of clamping glass tightly between cover plates and center section, glasses are bolted in place, remain loose. Steam joint is made by clamping gaskets and mica against center plate by means of the projecting surfaces of cover plate surrounding the glass as shown in Fig. 9 above. Glasses are mica-protected.

Pressure-sealed insert, Fig. 10, has a molded reinforced gasket fitted into a stainless-steel recess in body, providing a tight joint without excessive tightening of cover. Wide-shouldered cap screws and stainless steel spring cones limit sealing load on glass to predetermined safe value. Cones also allow for slight variations in gaskets, glasses, cover and body.

Mica, 0.015 in. thick, protects the glass. Tempered glass with a high endurance limit is used. Should this type glass fail in service it will develop an interlocking-type fracture, reducing the tendency to blow out.

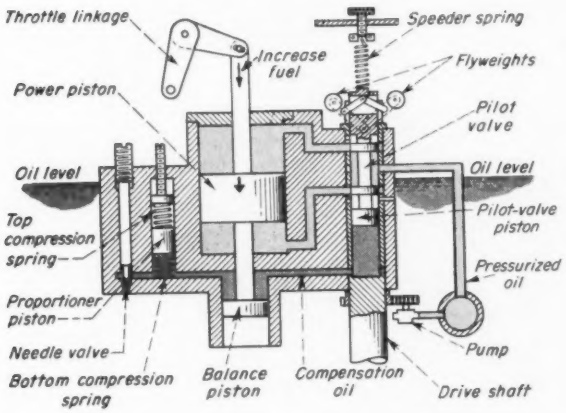
Gage Valves. Typical valve for 1500- and 2500-psi service is shown in Fig. 11. Nozzle, with integral stellite seat, is welded to body, making valve a one-piece unit. For 2500 psi, valve disk is stellited. Fig. 3 shows a complete gage assembly using these valves.

Planning. Every gage installation should provide easy, accurate reading of boiler-water level for longest possible service period. It should be designed so, if failure occurs, it is not a hazard to operating personnel.

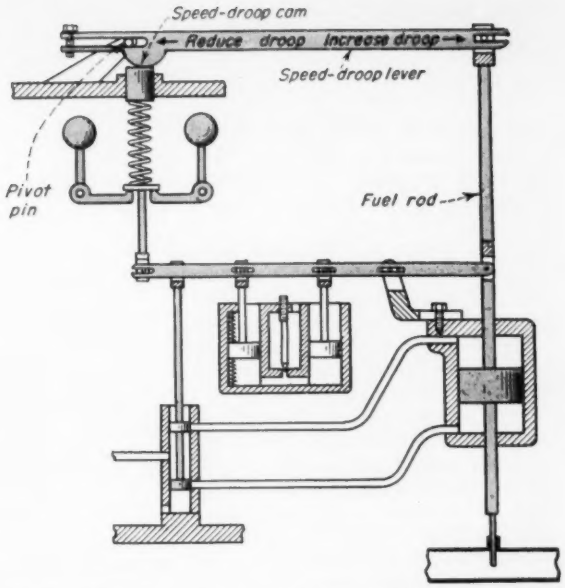
See that gage valves require only periodic lubrication, stay tight, and can be quickly and dependably operated when necessary. Gage repairs should be easy to make, with a minimum of tools. For best results it should be possible to make repairs on only one face of an insert at a time, without disturbing opposite side.

Gage Care. Follow manufacturer's instructions carefully. Post where they are readily available whenever maintenance personnel want to use them.

(*Continued on page* 192)



1 Isochronous governor controls speed droop by an oil connection between the power piston and pilot-valve piston



2 Speed-droop lever acting on the speeder spring provides permanent speed droop, which can be adjusted by operator

Diesel Governor Modification and Use

To be sure engines in different types of service have suitable speed characteristics, a correct governing unit must be chosen. Here are several good examples of choices for many usual jobs

By EDGAR J KATES
Consulting Engineer, New York, N. Y.

► OUR ARTICLE in the June issue showed how an isochronous governor could be made stable by using actuating and receiving pistons and a floating lever to apply temporary speed droop (compensation). Stability can also be obtained by making the power piston act directly on the pilot valve by means of a hydraulic connection.

Typical Unit. Fig. 1 shows such a governor. Pilot valve controls flow of pressurized oil to move power piston and change the position of engine throttle in usual way. However, pilot valve is recentered by an oil connection to power piston instead of by mechanical levers.

Governor acts like this: When engine load decreases, speed of engine and governor increase. Flyweights move out and pull pilot valve down, uncovering the ports to admit pressurized oil to under side of power piston. Piston moves up to decrease fuel flow.

As power piston moves up, balance piston displaces compensation oil upward to the place of least resistance, which is the proportioner piston. It moves up against its top spring, compressing spring to a force equal to the downward force existing on the pilot valve. Further movement of balance piston pushes pilot valve back to center, stopping the movement of the power piston at a decreased fuel position.

Proportioner piston, being still above center, is pushed back to center by its top spring at a gradual rate, determined by rate at which oil bleeds through needle valve. Opening of this valve is adjusted so pilot valve is kept centered by pressure of compensation oil until engine responds to decreased fuel rate and returns to its original speed. When compensation period ends, engine and governor are running at the original speed, and both pilot valve and proportioner piston are recentered. Power piston, however, is in a new position, supplying the amount of oil needed for prevailing load.

Governor Modifications. The basic governors described in earlier issues are often modified or fitted with auxiliary devices to meet special requirements. Let's look at some of them.

Many electric power plants contain several units generating alternating current. Each unit must take a share of the load while a constant frequency is held in the power system. This requires use of *isochronous* governors fitted with a mechanism to provide adjustable *permanent speed droop.* Units like this employ both temporary and permanent speed-droop mechanisms. Temporary speed droop is always effective, to prevent hunting. Permanent speed-droop mechanism can be adjusted, as required, from no droop (isochronous) to about 5% droop in steady speed.

Fig. 2 shows how adjustable permanent speed droop is added to the isochronous governor described in June POWER, p 82. Speed-droop lever introduces permanent droop by changing the force of the speeder spring.

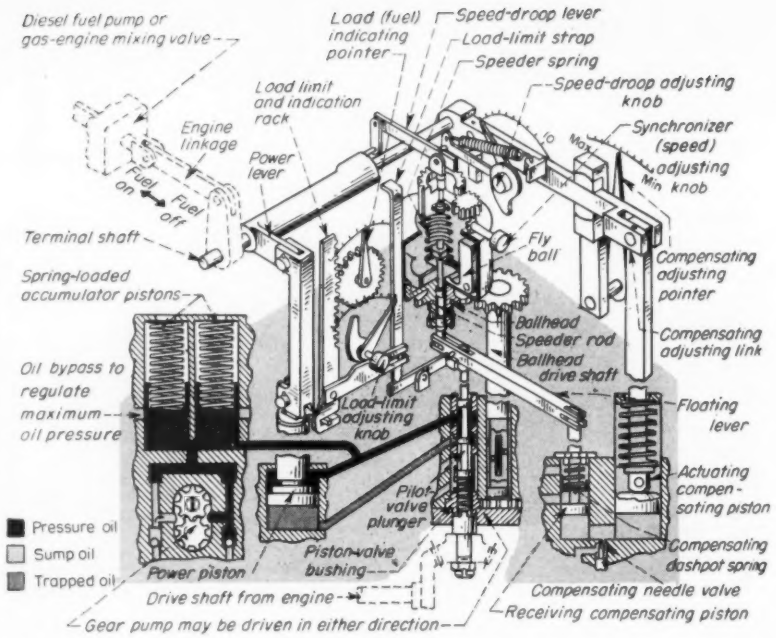
To adjust droop, speed-droop lever is shifted endwise to change its leverage. With lever shifted to right, a given movement of fuel rod causes a greater

(*Continued on page* 86)

movement of the speed-droop cam and a greater change in spring force. Shifting lever to left causes cam to have less effect on spring; speed droop is reduced. With lever shifted all the way to the left, cam nose comes directly under pivot pin, and cam has no effect on speeder spring. This eliminates permanent speed droop; governor becomes isochronous.

Fig. 4 shows a cross section of an isochronous hydraulic governor with adjustable permanent speed droop; Fig. 3 is a schematic of this unit. Speed-droop lever connected to governor terminal shaft varies the compression of the speeder spring when terminal shaft rotates in response to a load change. Effective length of speed-droop lever is adjustable from an external knob, permitting *permanent* speed droop to be changed while engine runs.

Floating lever changes pilot-valve position relative to the speeder rod, introducing *temporary* speed droop (compensation), which makes governor isochronous if the permanent speed droop is adjusted to zero. Compensating pistons and needle valve gradually remove the temporary speed droop.



3 Schematic diagram of the isochronous hydraulic governor in Fig. 4, showing the components used in its construction. Knobs on exterior permit easy adjustment

Variable-speed governor is one that controls engine speed at several values between minimum and rated speed. It resembles a constant-speed governor in its ability to hold engine at steady speed; it differs in that operator can adjust governor to maintain any one of several desired steady speeds.

Speed adjustment is obtained in most variable-speed governors by changing the spring force that resists the flyweight centrifugal force. We saw earlier how an adjustment of spring force is used to make minor changes in the control speed of a constant-speed governor. Speed adjusters for units of this type work through a range of only a few percent change in speed, but the same principle is used in many variable-speed governors to permit control speeds as low as one-sixth normal.

To work well through so great a range a special trumpet-shaped or conical speeder spring is needed because an ordinary cylindrical spring does not give as good control at reduced speed as at full speed. At reduced speed a cylindrical spring, which is stiff enough (large force per inch of compression) to match the flyweight force at high speed, is too stiff to match the greatly reduced flyweight force at reduced engine speed. Trumpet-shaped spring is so wound that at light loads (low speeds) all the turns are active and spring is quite soft. At high loads (high speeds) the larger turns touch each other and go out of action, leaving the smaller turns to provide a stiffer spring.

Two-speed mechanical governors control engine speed at idling and at high speed with two different springs. One is stiff for high speeds; the other is soft to give greater sensitivity, and less speed droop at low speed. The springs may be arranged to act either singly or in combination, Fig. 5.

In this unit, control lever is put in position shown if low-speed operation is desired. Then only the soft inner spring acts. For high-speed operation, lever is pushed to left, putting both springs in action.

Overspeed governors are safety devices that protect engine from damage that might be caused by overspeeding from any cause. When engine has a regular speed governor, overspeed governor functions only if regular unit fails.

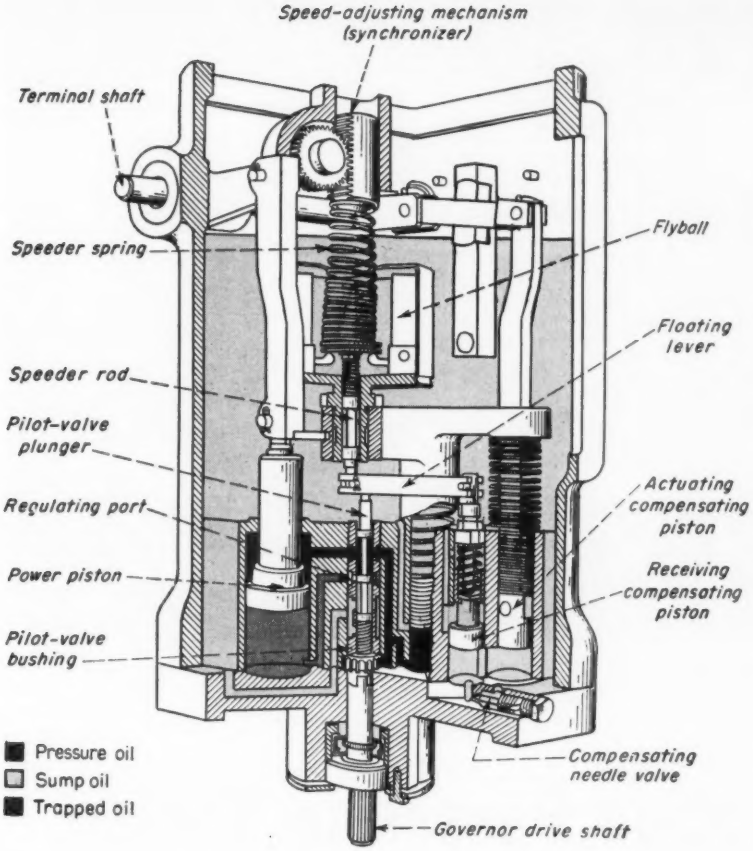
If overspeed control merely slows engine down, but allows it to continue running at a safe speed, it is called an *overspeed governor*. If it brings the engine to a full stop it is called an *overspeed trip*.

Overspeed governors and trips of all types use the principle of resisting the centrifugal force of a flyweight by means of a spring. The spring is preloaded to a force that overbalances the centrifugal force of the flyweight until engine speed rises above desired maximum value. When this occurs, the centrifugal force overcomes the spring force and puts into action the controls that slow down or stop the engine.

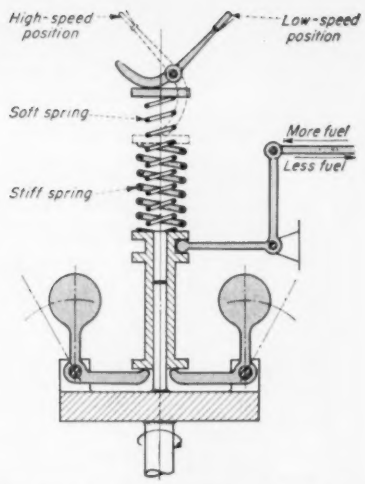
Overspeed governors generally act on fuel supply to engine cylinders, like regular units. So do many overspeed trips. However, it is possible for an engine to overspeed because fuel enters cylinders independently of the fuel-injection system. For example, oil or gas might accidentally enter the engine's air intake. Some overspeed trips guard against such occurrences, and shut the engine down by holding the exhaust valves open or by closing off the air supply.

Load-Limiting Governor. Too much fuel can seriously damage an engine. A governor, whether isochronous or not, responds only to speed changes. So if an engine slows down because load is excessive, the governor increases the fuel supply. To prevent excessive fuel supply under these conditions, most engines have a fixed collar or stop on the fuel-control shaft to limit the maximum amount of fuel supply, even though governor calls for more. This is called a *fuel-limiting stop*.

Fuel-limiting stops have their faults, however. If an extremely heavy load is put on an engine and causes fuel supply to reach the limit, engine speed drops below control speed. Engine then runs at throttle setting fixed fuel stop, as though it had no governor. Also, when running at reduced speed due to



4 Cross section of an isochronous hydraulic governor having adjustable speed droop. Note the speed-adjusting mechanism (synchronizer) and the compact design



5 Two-speed mechanical governor has two springs that act in combination

overload, engine cannot develop as much power as at full speed because power is proportional to speed. Thus, just when maximum power is demanded, developed power falls off.

Load-limiting governors prevent a loss of engine speed due to heavy load by limiting the *load* to the engine's safe capacity. They cannot be used for all jobs, because it is not always feasible to limit the load, but an important application is on diesel-electric locomotives. Here the load-limit device is an attachment to the governor. When the governor terminal shaft reaches the maximum safe fuel position, this device operates an electric control that reduces generator output. Engine runs at full speed, developing its full safe power.

Pressure-regulating governors are for engines driving pumps whose discharge pressure must be kept constant, as in pipeline service. Ordinary variable-speed governor can be converted to this use by adding a device to vary speed setting according to pumping pressure.

Pumping pressure acts on piston or diaphragm balanced by a spring and connected to governor's speed-adjuster. If pressure falls below desired value, diaphragm movement moves speed adjuster to increase speed setting. (Some designs have a servomotor for more power and sensitivity.) Engine runs faster at increased speed setting, and pump pressure returns to normal. Opposite occurs when pump pressure rises.

Governor Use. *Constant-speed governors* are for engines that must maintain steady speed while supplying a varying load. All mechanical governors have speed droop, and cannot maintain exactly the same engine speed at different loads. But speed regulation with this type is fairly close, 3 to 8%. This is close enough for many services like driving machine-shop line shafts or generators supplying loads that permit some variation in voltage and frequency.

Governors for engines driving generators always have accurate speed adjusters to (1) adjust engine's speed to conform with generator's rated speed (2) synchronize one ac generator with another (3) regulate electrical output of engines that are operating in parallel.

When engines are coupled through ac generators the speed adjuster is really a *load adjuster* because it can adjust load on engine without substantially changing its speed. Reason for this is that electrical forces of ac generators compel *all* coupled engines to keep in step and change speed in unison.

When speed adjuster of one engine is turned toward higher speed, fuel supply increases. If engine were running alone this would increase its speed. But since engine is electrically interlocked with the others, its speed increases only slightly. Engine *tries* to push ahead, its increased torque advancing the generator's phase angle, increasing the electrical output.

Hydraulic governors are becoming more popular for engines driving generators because frequency control is more accurate, voltage regulation is closer, and there is better load sharing. Last factor depends on speed droop of the governors.

Speed droop determines how a common load divides among two or more engines when load changes. Common load, whether connected mechanically or electrically, compels the engines to run at same relative speeds.

Suppose two engines having rated full-load speeds of 800 and 1200 rpm are running at full load driving paralleled 60-cps ac generators. If load falls and engine speeds increase to raise frequency 5% to 63 cps, *both* engines speed up 5%. First engine will run at 840 rpm, second at 1260 rpm.

If both engines have same speed regulation because both governors have same speed droop, say 10% from full to

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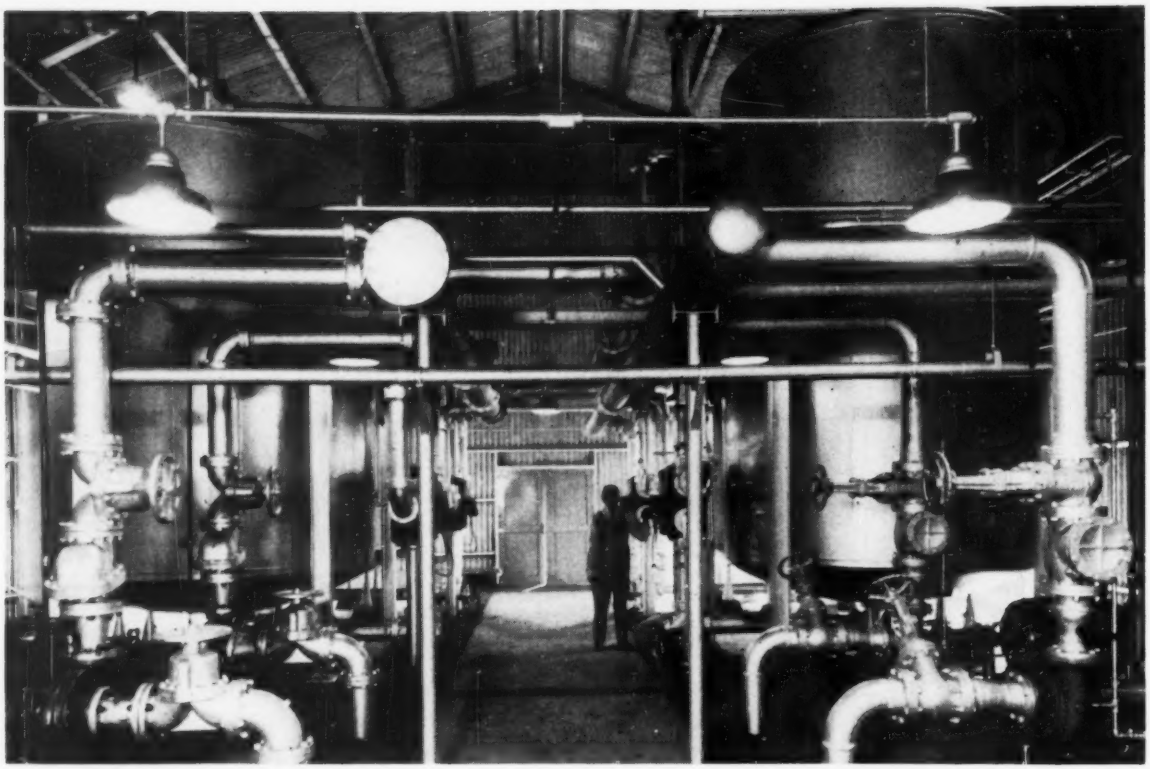


SILICA-REMOVAL demineralization, only about four years old, has made rapid progress in feedwater treatment. Its arrival was none too soon since the latest boiler designs now on the boards call for even higher pressures, and purer feedwater

Demineralization Passes in Review

Here's a fact-crammed summary and comparison of materials, processes to help gage the fast-moving demineralization field

By S B APPLEBAUM, *Manager, Water Treatment Div, Cochrane Corp*

► THE RAPID PROGRESS of demineralization is mainly due to the need to remove silica for boiler pressures above 500 psi. Above this point, silica distills over in vapor form with steam and, as the steam expands through the turbine, the silica crystallizes out as a glassy deposit on turbine blades. Ultimately the turbine must be shut down to remove this deposit by caustic scouring and, in the meantime, efficiency suffers as the silica deposit builds up.

The one way to prevent this is to reduce silica in the concentrated boiler saline to very low figures. This, in turn, calls for extremely low silica in the feedwater to avoid excessive boiler blowoff.

Limits of silica permissible at various boiler pressures have not been definitely determined, but at a 1951 ASME meeting in Atlantic City, Babcock & Wilcox Co engineers presented their suggested silica tolerances in the concentrated boiler saline, Table I, p 90. From this you can calculate the limits of silica permissible in the entering makeup water to limit boiler blowdown to 5 to 10% of makeup. By dividing the silica figures in Table I by 10 to 20 respectively, we have constructed Table II, p 90, to get these limits.

Various water-treatment methods reduce hardness, alkalinity and silica in addition to demineralizing, but the amount of silica these methods leave in the treated water is: cold-process precipitation, 2 to 3 ppm; hot lime zeolite, 0.5 to 1 ppm; demineralizing, 0.05 to 0.2 ppm.

Table II indicates boiler pressures above 1000 psi require silica in the makeup water to be between 0.25 and 0.5 ppm. This requirement makes demineralizing the only suitable method to avoid excessive boiler blowdown. But demineralizers are serving for boilers operating well under 1000 psi, even down as low as 600 psi, if the water composition and the investment justifies it as compared to other methods. Table III, p 91, shows indicated methods of water treatment for various boiler pressures and various raw-water compositions. From this table you can see boilers with operating pressures of 600 to 1000 psi have two possible choices, demineralizing and hot lime zeolite. Above 1000-psi pressure, though, demineralizing usually proves more economical.

Chemistry. Demineralizing is a 2-step process. First step consists of hydrogencation exchange, which converts all the salts dissolved in the water to their cor-

Basic Chemical Reactions in Demineralization, Regeneration Are Straightforward, Easily Understood

$$\begin{Bmatrix} Na_2 \\ Ca \\ Mg \end{Bmatrix}(HCO_3)_2 + H_2Z \longrightarrow \begin{matrix} Na_2 \\ Ca \\ Mg \end{matrix} Z + 2H_2CO_3$$

Sodium, Calcium and Magnesium Bicarbonate or Alkalinity + Hydrogen Zeolite → Sodium Calcium and Magnesium Zeolite + Carbonic Acid

$$\begin{Bmatrix} Na_2 \\ Ca \\ Mg \end{Bmatrix} SO_4 \text{ or } Cl_2 + H_2Z \longrightarrow \begin{matrix} Na_2 \\ Ca \\ Mg \end{matrix} Z + \begin{matrix} H_2SO_4 \\ \text{or} \\ 2HCl \end{matrix}$$

Sodium, Calcium and Magnesium Sulfates or Chlorides + Hydrogen Zeolite → Sodium Calcium and Magnesium Zeolite + Sulfuric or Hydrochloric Acid

1 Hydrogen cation exchange, the first of the two-step demineralization process, converts all salts to their corresponding acids; bicarbonates to carbonic acid, sulfates and chlorides to sulfuric and hydrochloric acid, respectively

$$\begin{matrix} H_2SO_4 \\ \text{or} \\ 2HCl \end{matrix} + A \longrightarrow \begin{matrix} 2HCl \\ A_2(H_2SO_4 \end{matrix}$$

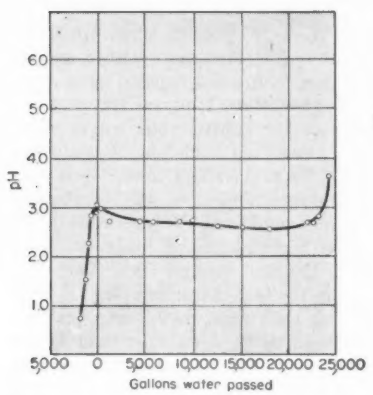
TMA + Anion Exchanger → Acid in Exchanger

2 Early anion-exchange materials were capable of adsorbing only the strongly ionized salts, and lost the weak ones

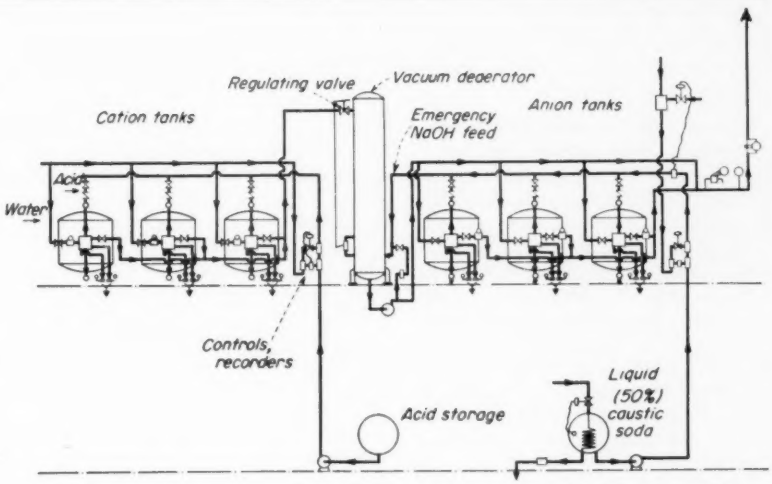
$$A\,OH + \begin{matrix} H_2CO_3 \\ \text{or} \\ H_2SiO_3 \end{matrix} \rightleftharpoons \begin{matrix} A\,HSiO_3 \\ \text{or} \\ A\,HCO_3 \end{matrix} + H_2O$$

Caustic Regenerated Anion Exchanger + Carbonic or Silicic Acids ⇄ Anion Exchanger holding weak acids + Water

3 New strongly-basic anion-exchange resins react on the CO_2 and silica, and hence remove these troublesome weaker acids



4 Instrumentation helps determine when to regenerate and when to end rinses



5 Regenerant measuring and its dilution is a vital part of accurate control over demineralization. Here's a case where ratio-control equipment does a full job

responding acids, Fig. 1. The bicarbonates are converted to carbonic acid, which a degasifier or decarbonator liberates; the sulfates and chlorides produce sulfuric and hydrochloric acids. Any nitrates present turn up as nitric acid.

Second step of the demineralizing process consists of an anion exchanger, regenerated with caustic soda so anion resin is in hydroxyl form. Incidentally, the first anion-exchange resins developed were weakbase resins, only capable of adsorbing the strongly ionized acids, such as sulfuric and hydrochloric acid, Fig. 2. But, these weakly basic exchangers could not remove weakly dissociated acids, like carbonic or silicic acids and, therefore, were not valuable for boiler-feed application. Fig. 3 shows how the new strongly-basic anion exchangers react to remove CO_2 and silica, and hence make demineralization important in the boiler field.

Cation Materials. For the first step, the hydrogen-cation exchange, there are today three successful materials:

1. Sulfonated coal, oldest of the hydrogen zeolites dating back to 1935, has the advantage of easy regeneration. It requires only a single strength of 2% sulfuric acid, introduced rapidly to avoid calcium sulfate crystallization on the exchange material. But its capacity is lower than the other available materials and, therefore, requires larger containers. Its cost, though, is lower and this frequently compensates for the larger shell. It is sensitive to high amounts of chlorine, say over 0.3 ppm, which may attack the material. But under the proper conditions and for waters relatively high in percent of alkalinity present, it is a very good material to use.

2. Medium-capacity resin, such as that made by Rohm & Haas, as their IR-112, and Nalco-Dow, as their Nalcite MCR, is relatively new, only about a year old. Like sulfonated coal it requires only a single strength of acid in regeneration. It comes as styrene beads but somewhat softer than those of the high-capacity resins to be described presently. As a result you may experience higher pressure losses. What's more, the bead particle swells during the hydrogen exchange run and contracts during the regeneration. So you have to allow for these volume changes. Further field experience will eventually determine whether these volume changes affect the long-term stability of the material.

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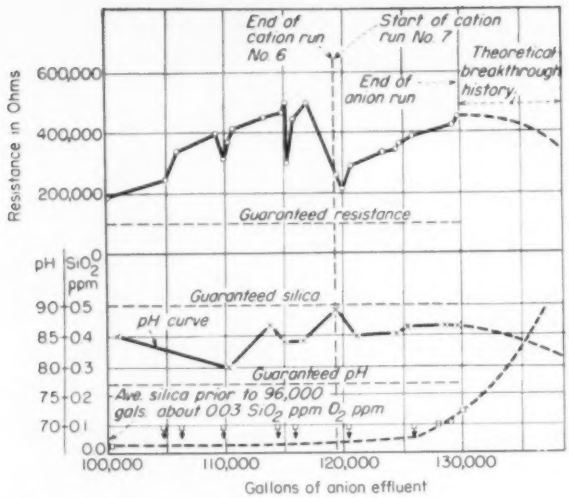


6 Silica usually breaks through a worn-down exchange resin first, so test for it to decide best regeneration point

I: Recommended Silica Tolerances for Boilers

Operating boiler pressure, psig	*Maximum silica in ppm in boiler salines*
600-800	25
801-1000	15
1001-1500	5
Above 1500	3

II: Silica Limitations in Entering Feedwater for Table I

Operating boiler pressure, psig	*Maximum silica in ppm in makeup to keep blowdown at 5-10% of makeup*
600-800	1.25-2.5
801-1000	0.75-1.5
1001-1500	0.25-0.5
Above 1500	0.15-0.3

3. High-capacity styrene resin, such as Rohm & Haas IR-120, and Nalco-Dow Nalcite HCR, are higher in capacity than the medium-capacity materials. They also come in bead form, but the beads are harder than the medium-capacity resin and, therefore, do not compress to form objectionable high-pressure losses. Furthermore, they undergo no appreciable volume changes when the material goes from the hydrogen to the sodium form, and vice versa, during regeneration. As a result these resins enjoy a satisfactory history of stability reaching back several years.

But, to realize the full higher capacity it is usually necessary to regenerate thus —progressively increase the strength of the sulfuric acid in about four steps of 2, 4, 6 and 8%. The low strength of acid at the start of regeneration scrubs out the calcium from the resin, and in that way minimizes the calcium sulfate crystal build-up on the resin. The higher strength of acid accomplishes the maximum conversion of the calcium, magnesium and sodium zeolite back to the hydrogen form.

Anion Resins

Anion Materials. For the second step of the demineralizing process you find four types of anion resins:

1. Weakly-basic materials of the condensation type, like Rohm & Haas IR-4B (incidentally one of the first successful weakly-basic anion-exchange materials developed), suffer as a class from a limited stability toward oxidizing and reducing reagents, particularly at higher than normal temperatures. In addition, this material also shows some instability when subjected to so-called acid shock. This refers to volume changes occurring in the resin particles when strong acid and strong alkali are alternately applied to them.

2. Styrene weak-base anion exchanger, illustrated by Rohm & Haas Amberlite IR-45, and Nalco-Dow Nalcite WBR, enjoys a higher ability to withstand acid shock and also resist oxidizing and reducing agents; hence it is more stable than the condensation materials.

3. Most strongly-basic anion exchanger, the first of the silica-removal anion-exchange resins developed, is of the type similar to Rohm & Haas Amberlite IRA-400, or Nalco-Dow Nalcite SBR, often called Type I resin. As a class, it is so strongly basic that it requires more caustic soda per cu ft to dislodge the silica completely during regeneration than does Type II resin later developed. Further, it usually has a lower capacity than Type II resin per pound of caustic used in the regeneration of each cu ft of material.

4. Less-strongly-basic silica-removal anion resin, similar to the Rohm & Haas IRA-400, and Nalco-Dow Nalcite SAR, is often called Type II resin. It is less strongly basic than Type I, and, therefore, requires less caustic soda per cu ft for its regeneration, and has a higher capacity. There is evidence, though, that during the first two years of its operation its silica-removal capacity may decrease about 20%, and in the third year an additional 10%. After that it seems to reach a plateau with no further reduction in silica-removal capacity. Where the carbonic plus silicic acids present exceed about 25% of the total acidity, Type I resins seem preferable because they are more stable and do not lose their silica-removal capacity.

Regeneration. It proves very valuable to heat the caustic soda up to about 95 F, and then hold time of contact to about 90 minutes at a caustic-soda solution strength of 2 to 4% (preferably 4% to complete the regeneration of the anion material and dislodge the silica from the resin completely). The value lies in the fact that it removes all silica during each regeneration and prevents its bleeding off during the ensuing run to interfere with obtaining the essential low silica results.

Reaction Problems

Cation leakage. Proper function of both steps in demineralizing is vital if you hope to get the desired final effluent quality. An incomplete conversion of the salts to their respective acids by the cation exchanger carries the name of cation leakage. When it occurs, some of the calcium, magnesium and sodium, but principally sodium, leak through into the anion exchanger where they cannot be removed and get out in the form of alkalinity and chlorides in the final effluent. Because of this action, too great a cation leakage usually results in sodium salts showing up in the final effluent at a concentration above the desired low electrolyte content. Any of the following can cause cation leakage: (1) too heavy a rate of flow per sq ft of area (2) too shallow a resin bed (3) too little acid applied in regeneration per cu ft of resin (4) mechanical channeling due to dirt in cation resin or to pressure losses.

III: Indicated Treatment Methods for Various Waters, Boiler Pressures

Boiler Pressure, psig	*Raw-water alkalinity*	*Raw-water silica*	*Water-treatment methods indicated*
Over 1000 psig	—	—	Silica-removal demineralizing
600-1000 psig	—	—	a. Demineralizing b. Hot lime zeolite
450-600 psig	—	Above 3 to 5 ppm	a. Demineralizing b. Hot lime zeolite c. Hot lime soda hot phosphate
	Above 50 ppm	Below 3 to 5 ppm	a. Hydrogen-sodium zeolite b. Cold lime zeolite c. Hot lime zeolite
	Below 50 ppm	Below 3 to 5 ppm	a. Sodium zeolite plus chloride Anion exchanger b. Hot lime zeolite c. Sodium zeolite
Below 450 psig		Above 8 to 15 ppm	a. Hot lime zeolite b. Cold lime zeolite c. Hot lime soda
	Above 50 ppm	Below 8 to 15 ppm	a. Hot lime zeolite b. Cold lime zeolite c. Hot lime-soda d. Sodium zeolite plus chloride anion exchanger
	Below 50 ppm	Below 8 to 15 ppm	Sodium zeolite

In designing a demineralizer your first step, then, is to carefully examine the water analysis particularly for percent alkalinity and percent sodium. You can vary amounts of acid per cu ft, depending on these quantities.

Anion-Exchange Design. Type I or II strongly-basic anion-exchanger ratings depend principally on the percent of weak acids and particularly the percent of silica present, plus how low the silica must be reduced. From these data you must first decide whether to use Type I or II resin, and then give the resin selected a rating in kg/cu ft with a given dosage of caustic soda per cu ft. You calculate the total exchangeable anion load which the anion-exchange stage must handle in this way:

Sulfates + chlorides (as $CaCO_3$) $\times$ 1.0, plus
Free CO_2 (as CO_2) $\times$ 1.15, plus
Silica (as SiO_2) $\times$ 0.83, gives
Total exchangeable anions (TEA) (as $CaCO_3$) in ppm

This TEA you then divide by 17.1 to obtain the gr/gal of TEA expressed as $CaCO_3$. Next, multiply the number of thousand gallons desired between regenerations by this TEA to establish the total kgs between regenerations. The total kg, in turn, divided by the rating of the resin you select in kg/cu ft gives the number of cu ft of anion material required.

Cation units have to be large enough to supply water to service, as well as water wasted in backwashing and regeneration of the anion unit. Therefore, after you establish the number of cu ft of anion resin, add on between 100 and 160 gal per cu ft of anion waste water to the required cation-resin capacity.

Equipment Costs

Degasifier Economics. The effluent of the cation-exchange stage contains carbonic acid in amounts equivalent to the original alkalinity in the raw water. The strongly-basic anion-exchange materials remove it, but you must include enough extra anion resin for the job, plus enough extra caustic soda to regenerate the added anion resin.

Where alkalinity in the raw water runs sufficiently high and the plant is large enough, a degasifier or decarbonator, to remove by aeration the free CO_2 formed from the carbonic acid, usually proves economical. This equipment can reduce the CO_2 to under 5 ppm so the anion-exchange unit has little CO_2 removal to accomplish.

But, degasifier costs mount because you need a level controller ahead of it, a storage tank under it, two acid-proof booster pumps after it, including rubber-lined suction and discharge valves, check valves and miscellaneous rubber-lined interconnecting piping. Against this cost you must balance the saving in caustic soda the degasifier can realize. Wherever possible, unless the saving in caustic soda pays for the degasifier investment in about one year, the trend is to omit the degasifier.

When you do use a degasifier make it large enough not only for the service rate, but also for the anion rinse rate during the regeneration of the anion unit as well. This thinking carries over to the design of the cation units too. Make them large enough to take care of the increased rate for anion rinsing.

Demineralized Water Storage. Often where adequate storage is available one cation and one anion unit alone will suffice. The storage takes care of the outage period during regeneration—a period amounting to about four hours. Cost of a large enough storage tank has to be balanced against the saving in omitting a second pair of exchange units. The storage tank must be corrosion-proof, and, if made of steel, protected by a suitable lining. In some cases sprayed rubber linings have been applied. Wood storage tanks prove economical and avoid special linings.

Mechanical Aids

Automatic Controls. Need for regeneration may develop at any time, and since it requires four hours you'll find it saves you an extra operator's pay on each shift to have the job done by automatic controls rather than manually. What's more, the work is highly repetitive and a natural for automatic controls. With them, we suggest you initiate the regeneration by pushbutton and end it the same way before you put the unit back on the line. This way, the operator is in contact with the plant and observes its operation at the end of runs and at the end of regeneration. Without such pushbutton control the operator can get the false impression that the demineralizer can operate entirely by itself without any observance.

Often you'll find the necessary instruments to observe the quality of the effluent and number of gallons treated on a panelboard. It is placed at a convenient spot in the power plant where an engineer is always available to push the necessary buttons on the panelboard to start regeneration. Automatic controls then carry out all the regeneration steps under proper mechanical and electrical supervision. They avoid errors of the human equation or negligence.

Further, it is usually advisable to employ a single-control multiport valve instead of a nest of valves. This simplifies the valve control and eliminates the possibility of irregularity in operation. Such multiport valves, however, should be fully acidproof, preferably rubber lined, and the individual valve

(*Continued on page* 196)

HOW TO ORGANIZE YOUR NEW POWER PLANT—3

Plant Personnel Make or Break Station Operation and Maintenance

Selecting the men to run a plant is fully as important as choosing the equipment. Here's a rundown on some points to consider in organizing your manpower, factors that control

By D C SWIFT, *Ebasco Services Incorporated*

► MANY FACTORS affect the manpower needed to run a power plant, such as number and size of units, plant arrangement, centralization of control points, automatic controls, fuel type, steam cycle, cooling and feedwater supply and treatment, characteristics of plant load.

Equipment Size, Grouping. Generally speaking, two boilers or two turbines of a given size need more operating and maintenance attention than a single unit of double the size. But, a second boiler and turbine may often be added to a single-unit plant with little increase in operating personnel. Two units with adjacent controls may be run almost as easily as one. Unless units are quite simple, an added third unit is likely to need a second man to handle it.

Grouping units in pairs gives a rough measure of manpower needed. Although controls may be exactly the same, larger units often justify more manpower because of the larger investment, greater dollar losses with decreased efficiency, and greater operating difficulty because of larger size. Increased labor for large units is usually less than that for two small-sized units.

Control Arrangement. You lower needed manpower by conveniently locating boiler, turbine and auxiliaries in relation to each other for easy operator access. With centralized control, the amount of equipment one man can control is limited only by the number of things he has to supervise and analyze. Instruments permit him to use controls more intelligently.

Maximum reduction in needed manpower comes through using centralized control, automatically operated, with suitable instrumentation including recorders and alarms. In the future, as automatic devices are developed and perfected, completely automatic operations and control, including starting, stopping and low-load operation, may be possible. Then, the operator's only duties may be to check the automatic equipment to see that it functions properly.

Steam Cycle. Higher steam pressures and temperatures call for more careful operation and maintenance. The more-complicated construction of equipment increases the chance of damage from misoperations. As the cycle becomes more complicated with additional feedwater heaters, resuperheaters, automatic extraction turbines, etc, the degree of operating skill needed becomes greater. Economizers, air preheaters, dust collectors, forced- and induced-draft fans, steam-temperature controls —all need attention and maintenance.

Fuel. Natural-gas supply alone needs little attention beyond maintenance of correct supply pressures. Other gas fuels, like coke-oven or blast-furnace gas, introduce increasing complications. Standby oil fuel needs additional equipment, such as tanks, pumps, strainers, heaters, which must be looked after. Oil alone usually requires larger and duplicate fuel-supply elements. Extra men may be needed to operate these in larger plants, and to handle receipt, unloading and storage of fuel.

Coal and other solid fuels up manpower needs materially to unload, store and fill bunkers. More labor is needed to (1) run and repair coal scales, and pulverizers (2) clean steam-generator heat-transfer surfaces (3) remove slag, flyash and ashes. A coal-burning plant may require 30 to 50% more operating and fuel-handling labor than a gas-fired plant.

Water supply and its treatment for cooling towers need attention. Water from wells involves pumps, collecting lines, and perhaps a complicated water-treatment plant, with an extra man or two per shift. Extra maintenance may be needed on the screens, if a plant uses river water that is dirty, corrosive or erosive, and perhaps subject to large level variations. More operating labor may also be required. Extra complexity of feedwater treatment may occasionally call for an extra operator per shift, and extra labor for testing and controlling feedwater. Manual boiler feedwater regulation may require a lot of extra labor, particularly on a variable-load station.

Station Loads. Running with a limited number of operators may delay putting a plant back into service after an interruption. A fluctuating variable

load requires more operating attention than a steady load, and probably more maintenance also, unless extreme overloads are carried continuously. Daily starting and stopping probably require extra operators, but during shutdown periods operator needs fall below normal.

Operating Force. Centralized control and instrumentation have greatly reduced labor requirements and improved coordination of plant operation. Even in the smallest plants with considerable automatic control, two men per shift are usually considered the minimum need. With two men, the illness or sudden death of one will not leave the plant unattended.

With units of 20- to 60-mw capacity, minimum labor would probably be one man to a boiler-turbine-generator unit for the control room with additional help for auxiliary attendance as needed. For larger units, several men are generally used in the control room, with increased attendance outside also. However, the capacity that can be operated properly per man continues to increase with larger units.

If boiler, turbine and generator controls are separated, even though brought to individual central control areas, two boilers, two turbines, and two to four generators per man are usual maximums to be handled. Sometimes one man operates as many as four gas-fired boilers, but this is an exception. A switchboard operator may be able to handle more than two units if he does not supervise too many local feeders, too much transmission-line switching, or answer too many telephone-board calls.

Fuel facilities, boiler or turbine auxiliaries, and manual operation of disconnects and switches normally need additional help.

Careful study of the new plant and comparison with other plants indicate the number of men needed on each shift. The usual work week is 40 to 42 hours so four men must be used to cover each shift position. To avoid overtime, one-half to one additional man per position may be needed to allow for vacations, sickness, absenteeism or job training. The shift supervisor may be a working or nonworking foreman. Usually one foreman supervises seven to ten men. More than this number usually results in the men not being properly directed or checked. Shift supervisors may report to an operating supervisor, a plant superintendent or his assistant.

General Plant Labor. Crews must be provided for fuel and ash handling, efficiency and test work, and maintenance work. Each crew has a supervisor reporting to the plant superintendent. Coal-handling men may move 20,000 to 50,000 tons of coal per year. Results crew's size depends on amount of automatic control and instruments, partly on steam conditions and water-treatment facilities, partly on amount of fuel burned. Intensive testing activity will probably yield not over 2% return on money spent for fuel, so payroll for efficiency work should not exceed that amount.

In smaller plants, there are usually two maintenance sections, electrical and mechanical, directly under the plant superintendent. In larger plants, there may be numerous foremen. The mechanical group needs men for painting, brickwork, insulation, pipework, boiler, auxiliary, turbine repairs. The electrical group works on motors, controls, switches, wiring, cables, exciters and electronic equipment.

In small plants, one man may have to cover several of these fields, with some work let on contract. In large plants, certain men may specialize on various types of repairs.

Maintenance work in a new plant may be quite limited for several years. There usually are, however, a number of uncompleted construction items and small improvements left to maintenance forces so they are kept busy until repair needs reach a steady state. In a single-unit plant, operators may assist with overhaul work during shutdown periods. On larger systems, maintenance men are sometimes shifted to various plants as needed. After a steady state has been reached, number of maintenance men usually equals one-half to two-thirds of the number of operators. About 20 to 25% of the maintenance men are electrical workers.

Janitors, yardmen, gatemen, watchmen, and handy men may come under the superintendent or operating supervisor. Janitors usually clean offices, halls, walks, toilets and plant floors, while operators clean items of operating equipment. Number of gatemen, guards and yardmen depends on plant size, layout and company policy.

Keeping of stores, records, time, accident, coal, operating, maintenance records, etc, may be done by (1) the superintendent in a very small plant (2) clerks or timekeepers in a medium-sized plant (3) an office force in a very large plant. Number needed for this work usually runs about 2 to 3% of the men in the plant.

Plant Superintendent. It is poor economy to stint on the salary paid a competent superintendent. A second-rate man can lose the small difference in salary many times over in unnecessary outages, mishaps, high maintenance, operating inefficiencies and heavy labor turnover. A plant superintendent should have considerable operating experience, and good background of technical plant knowledge and maintenance.

He should be in good health, intelligent, stable, and able to control men and command their respect. He should be a leader and know how to delegate responsibilities so the plant runs itself when he is not there. Place the new superintendent in charge some 12 to 18 months before trial operations begin.

Plant Supervisors. Shift engineers should have pretty much the same qualifications as the plant superintendent, perhaps with shorter experience. The results engineer, maintenance and yard foremen should have had considerable experience in their specialties. They should be cooperative and have the initiative to do work as needed.

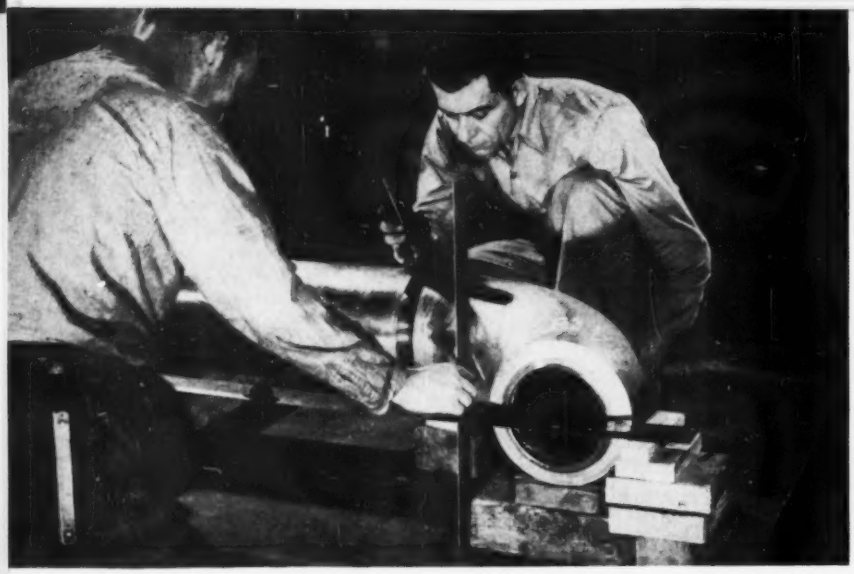
Operating and Maintenance Men. Junior plant operators, maintenance and test men should be reasonably intelligent. While plant experience is desirable, it is not essential. It is usually better to hire local men, even though inexperienced, who are likely to find their work and surroundings satisfactory, rather than to import experienced men from other localities.

Operator Training. If possible, key men should be sent to a plant similar to the new one to become familiar with the equipment type. Usually a training period of one to three months can be spent profitably. Most benefit results from allowing trainees to actually operate and maintain machinery.

About six to eight weeks before starting, the shift engineers and other key men should enter the new plant to become familiar with it. Include other operators if at all possible. Let each man draw up piping and electrical diagrams of the systems. Prepare preliminary operating instructions for each piece of equipment. Classes in construction and operation should be held, with men answering test questions. Operators should have the opportunity to inspect equipment as it is assembled. Allow maintenance men to assist with final alignment checks and lubrication so as to become familiar with the machinery.

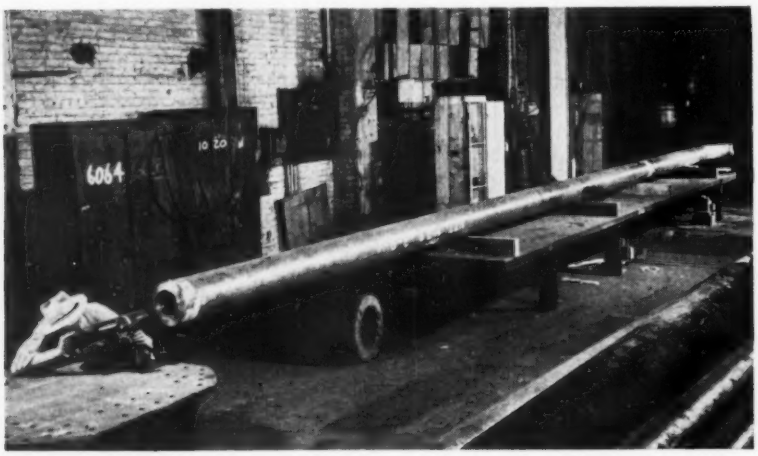
Electrical Work. The electrical foreman and his assistants should become familiar with all electrical prints. They should check conduit runs and plant circuits as they are installed. Helping with assembly of switchgear, transformers, regulators, controls, instruments, etc, gives valuable training. Relays and alarms should be tried out and adjusted as needed. Let one or two men assist

(*Continued on page* 206)



1 Setting up the joint to be welded at the welding station involves careful alignment of parts. This is followed by tack-welding to keep parts firmly placed

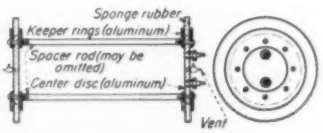
2 K-weld root bead is laid while pipe interior is under inert-gas pressure



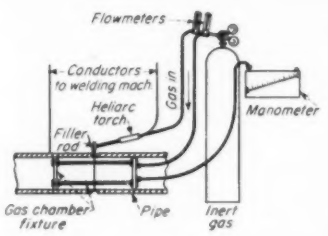
5 24-power spotting scope helps the supervising welding engineer to examine the inside surface of K-weld root bead located near far right end of the piping run

6 Interior of root bead looks like this through powerful spotting telescope

Gas-Chamber Fixture Confines Inert Gas to Weld Area



Typical gas-chamber fixture has two disks held by spacer rods



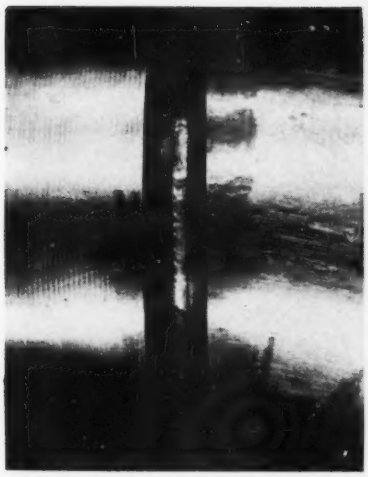
Fixture in pipe confines inert gas inside of the joint being made up

Varying pressure of gas in chamber fixture controls shape of interior surface of weld from convex to flush to concave with rising pressure

Inert Gas

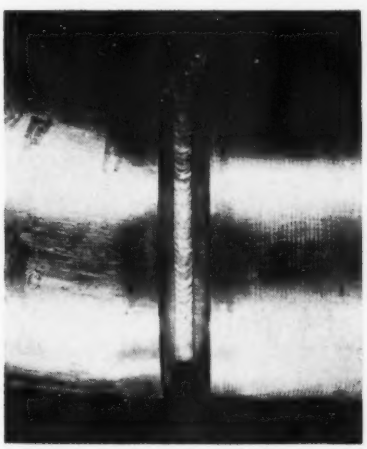
► M W Kellogg Co of Jersey City, N. J. has developed a new method of welding without backing rings called K-Weld Process. It has been successfully used to weld points in 9½-in. OD × 1⅝-in. wall austenitic stainless steam piping for 2350-psig 1100-F service on two 145,000-kw units in Kearny station of Public Service Electric and Gas Co of New Jersey.

K-Weld Process uses inert-gas shielded arc welding to apply the initial or root bead to the joint being made up. In finishing the weld you may use the same process or, for economy reasons, the metal-arc process, or any acceptable



3 Finished root bead completes first critical step to form h-p pipe weld

4 Light and mirror inserted in pipe end is pushed into position under the weld in pipe interior. This is the first step in visual inspection of inside surface of weld



7 Second bead laid on top of root bead by any normal metallic arc process

8 Penetrant-oil examinations are made periodically as the pipe weld is built up. These reveal minute cracks that may occur from incomplete penetration of metal

Doubly Shields Improved Pipe Welds

fusion-welding method. The inert gas in the first step may be either helium or argon or a mixture of the two.

Gas shielding of welds prevents oxidation and aids penetration of the parent weld metal, making a sounder joint. In most work the molten metal is gas-shieled only on the side the welder works on. This means that the root bead, laid in a pipe joint or other surface, is not protected on the interior side in the usual process.

To get this extra protecting and control bead contour, K-weld Process uses the gas-chamber fixture shown, bottom p 94. After the pipes to be joined are properly aligned this fixture is inserted as shown. The two disks form a chamber inside the pipe. The inert gas enters this chamber as shown and its pressure is indicated by the manometer. The gas leaks out through the butted ends of the pipe forming the joint to be welded. The chamber gas pressure can be regulated at will. Lower sketches show how the inside contour of the weld bead can be shaped by varying the chamber pressure. At low pressures the bead forms a convex inner surface. Raising the pressure gives it a flush surface, while with high pressures the surface becomes concave, that is, slightly hollowed.

Codes and specifications usually require an overlay, so the convex interior bead surface will be the most common. The flush contour has advantages where erosion must be avoided, pressure drop must be minimized, or where drainage must be complete. The concave contour would not be used because it reduces the weld strength.

In making a joint the pipe ends are preferably counterbored to an inside diameter with a tolerance normally used for backing rings. The lip thickness should be concentric with the counterbore, and reasonably uniform. The pipe

(*Continued on page* 96)

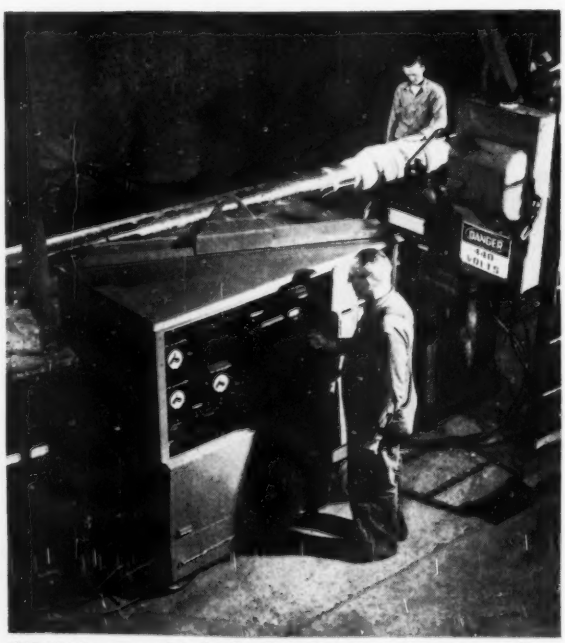
9 Final reinforcing beads finish the successful welding of pipe for 2350-psig 1100-F steam service. Conventional fusion processes are used to complete weld

10 Grinding wheel dresses finished weld before making the final inspection

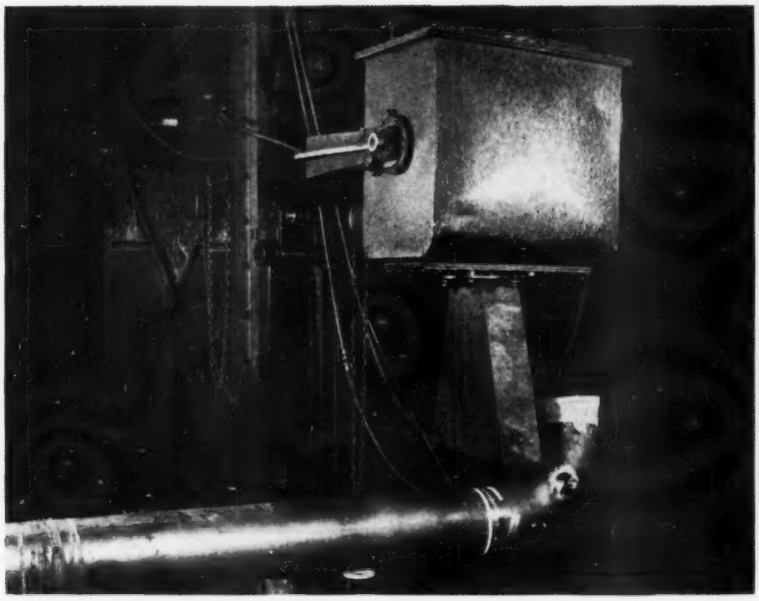
13 Post-heat treatment of weld must be carefully controlled by attaching thermocouples to measure metal temperature

Controlling Interior Gas Pressure Shapes the Inside Contour of K-Weld

14 Welded joint is wrapped with asbestos paper over which several coils of wire are placed in readiness for heating



15 High-powered induction heat-treating equipment performs stress-relieving of the welded joint in h-p piping units



11 X-ray of completed weld is an important step in making final inspection. Sensitivity of X-ray inspection decreases as the pipe wall and weld become thicker

12 Penetrant-oil examination of the finished weld follows X-ray inspection

ends are aligned and butted. While the lip faces need not be pressure-tight, they should be close enough to maintain the required gas pressure inside the joint.

The inert gas first flows long enough to flush air out of the chamber. During welding the pressure is closely controlled to give the proper inside contour. The root bead is deposited with the ordinary heli-arc technique with a fairly uniform advance. While the next pass may be deposited with 1/8-in.-dia coated electrode, it is preferable to use a 3/32-in.-dia coated electrode to insure against inadvertent burn-through. Narrowness of the groove at that level also favors use of the thinner electrode. After the second pass the internal fixture can be removed and the weld completed by any conventional fusion process. This process may be used for welding in all positions: down hand, vertical, horizontal and overhead.

Test Results. Weld quality obtained with this process easily meets all X-ray, physical and mechanical requirements of the *ASME Boiler Code*, and other codes and specifications. Tensile, bend, impact and torsion tests have shown excellent properties of the welds. Micro- and macro-examination show no tendency to crack formation, or undercut at the edges of the inside bead. Specimens have been completely flattened with no evidence of failure. All root beads were "as deposited," only the corners of the specimens being relieved. Penetration into the base metal has always been excellent without undercutting or other surface discontinuity.

This process is not limited to girth welds in piping. It has also been used on longitudinal welds and through welds at branch connections. You may use it for any through-welding on piping, small pressure vessels or other pressure equipment. It proves useful as a substitute for double-welded joints. Ability to complete welds from one side has advantages in the way of operator comfort where high preheat or hot weather is involved. There may also be economic advantages.

On larger pressure vessels and similar applications special fixtures may be needed to reduce gas consumption. Such equipment, however, is not expensive and can be easily adapted to a reasonable range of diameters.

You may use this process with any metal or alloy that can be fusion-welded. Its entire development has been associated with the welding fabrication problems of Production and Special Projects Departments of M W Kellogg Co. Consistent elimination of cracks and undercutting was realized on extremely high-strength rocket motor shells in which heat treatment after welding involved a drastic quench.

This process has helped eliminate root cracking associated with austenitic welding. It gives a completely satisfactory weld for fired service in furnace and superheater tubes, and for welds in extreme erosive service, such as fluid catalyst transfer lines. Successful welds have been made with various grades of carbon and carbon-molybdenum steel, chromium molybdenum steel, austenitic steels, nickel, monel, inconel and copper. This process should be well suited for welding titanium.

Operator Requirements. Full penetration has been consistently secured without demanding more than average ability of the operator. The method uses standard nonconsumable electrode-welding equipment. It has been demonstrated that satisfactory penetration is obtained by welding operators selected at random, using the K-weld Process for the first time. Control of pressure and physical dimensions replace the high degree of inherent skill demanded by conventional methods. This relieves the operator of considerable physical strain usually involved in exacting welding work.

Selection of gas pressure, weld-groove dimensions and the welding-machine setting is dictated by type of material and not by wall thickness. The gas pressure supports the weld metal during its solidification and cooling process with just the right support to give the desired inside contour.

In one unusual application, 1-in. 12-gage carbon steel condenser tubes had to be butt welded to form the needed length for hair-pin shaped tubes. Because of the lengths available, the weld had to be in the bent portion. All bends were made without failures.

AIR DUCTS, 24x6 feet, extend the entire length of each tunnel. The air slots, marked by an arrow, are placed 15 feet apart

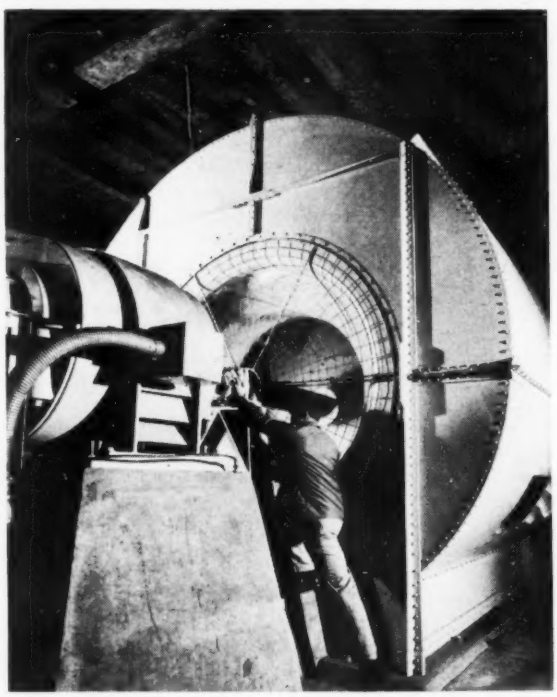
Giant Lungs for New Parkway Tunnels in Pittsburgh

► ONE MORE LINK in Pittsburgh's redevelopment program was completed June 5 when the Penn-Lincoln Parkway Squirrel Hill Tunnels opened to traffic. Air supply and exhaust details of these twin-tube tunnels are most interesting.

Eight Westinghouse Sturtevant Airfoil fans supply 1.9-million cfm of fresh air to the tunnels. Two blower and two exhaust fans are housed in ventilation buildings at each end of tunnel. Only two fans ventilate each tunnel during low traffic loads. The other fans run only during morning and evening rush hours, or in emergencies.

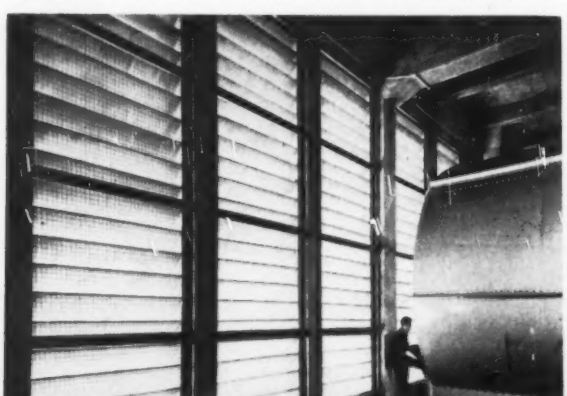
Total motor horsepower for driving fans is 1350. Two motors drive each fan. They are connected and geared together to provide 3-speed operation.

Sixteen manually operated fire-alarm stations in each tunnel flash a red light at tunnel entrance to stop traffic in event of fire. Fans exhaust the affected tunnel quickly.

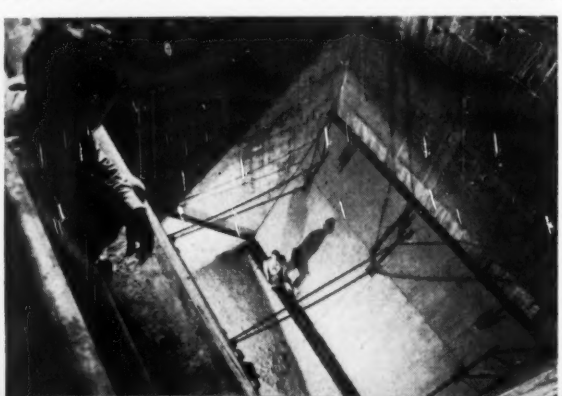


ONE OF EIGHT fans that ventilate Penn-Lincoln Parkway tunnel

LOUVERED and screened wall for fresh-air intake to the fans

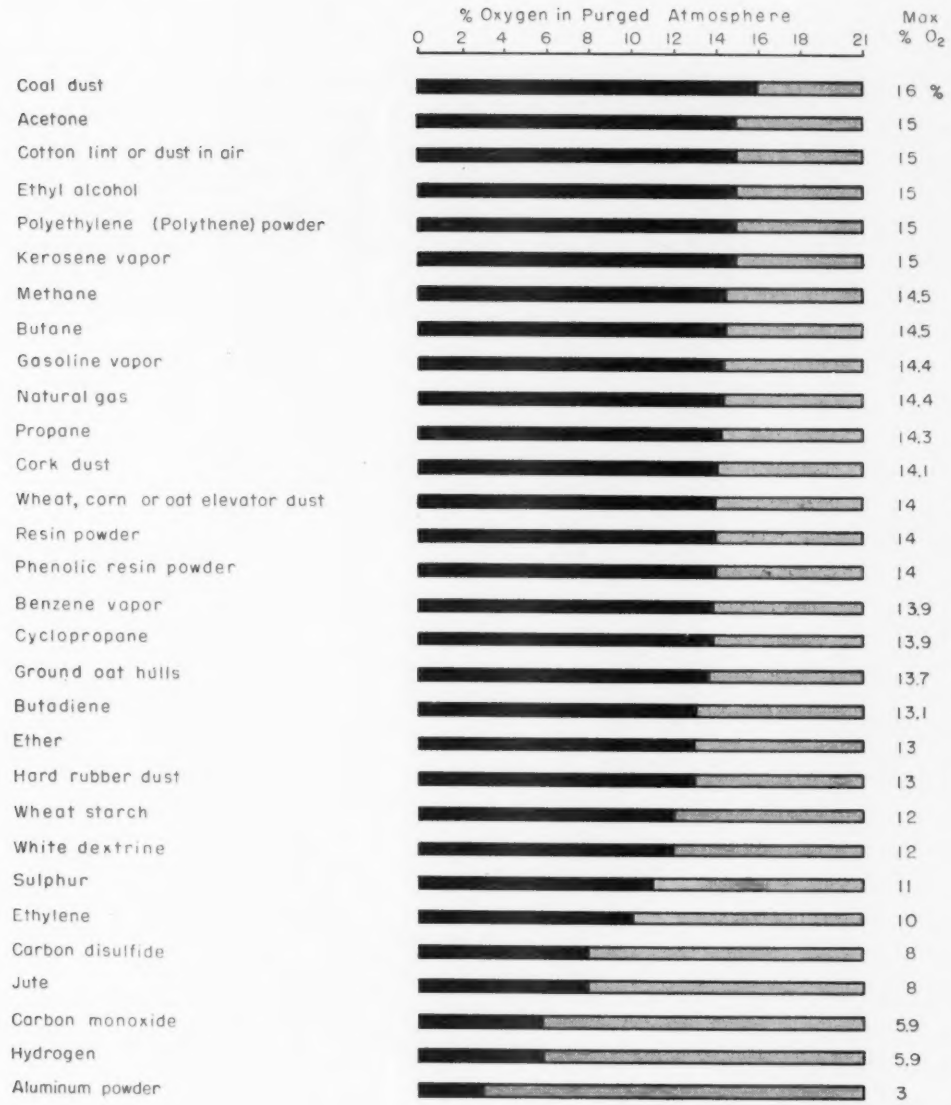


DAMPER GATES divert air from one tunnel to other in emergency



Power's DATA SHEET

No. 254



To Prevent Explosions Avoid Maximum Oxygen Limits

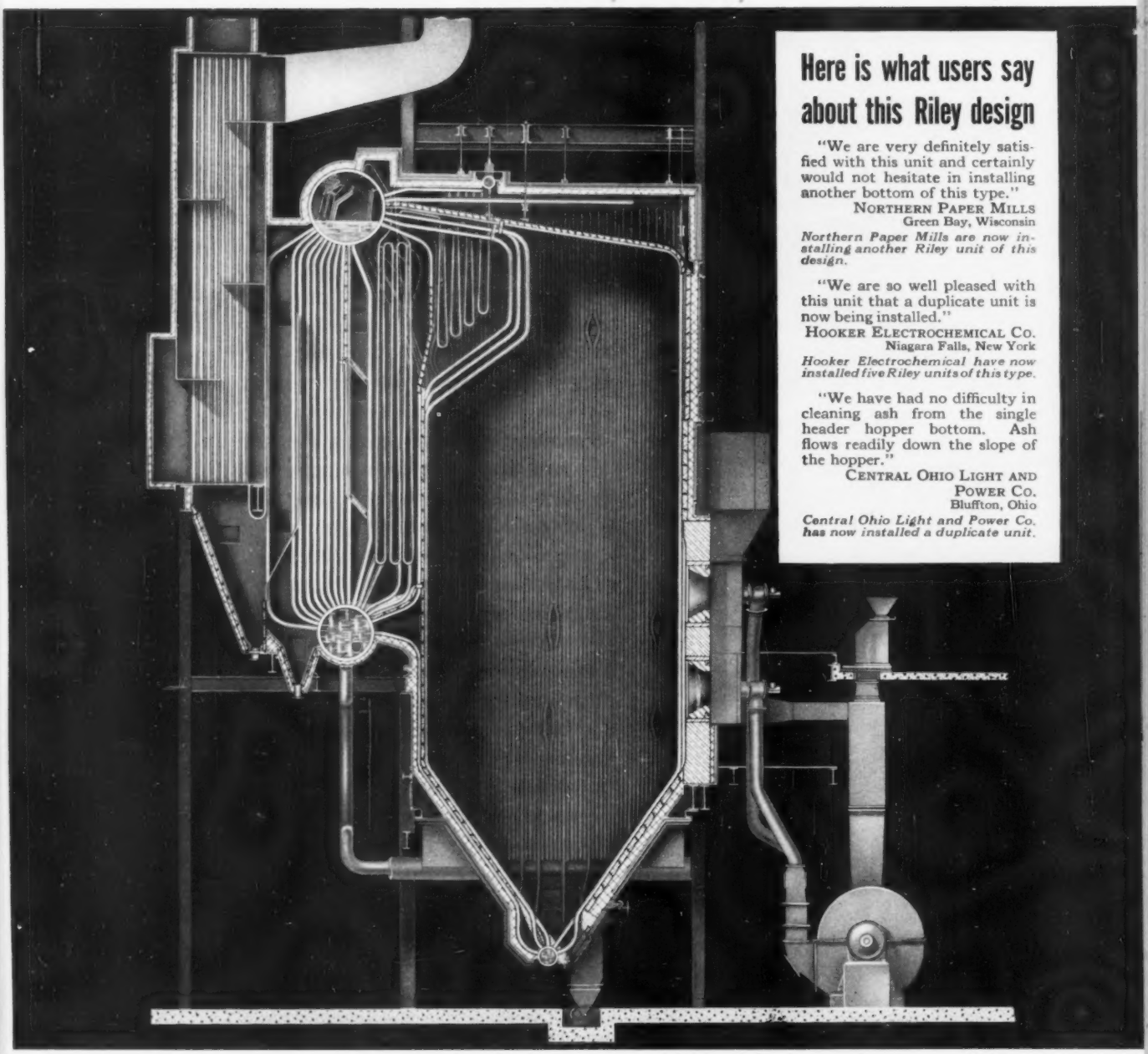
► GAS AND DUST EXPLOSIONS may be prevented by keeping the oxygen content of the mixture below given concentrations. This can be done by adding an inert gas, such as carbon dioxide, nitrogen, helium, steam or exhaust gas, to the mixture. Adding the inert gas to the combustible mixture narrows down the flammability limits which, through this procedure, may actually be made to disappear completely.

Inert gases and vapors do not all have the same flame-quenching ability. The chart, which is shown above, gives the maximum allowable oxygen when diluting with carbon dioxide at atmospheric pressure. To provide a margin of safety, reduce the oxygen content as far as is practicable below this maximum permissible limit.

By J D CONSTANCE *Cliffside Park, N. J.*

© POWER

You save in many ways when you



Here is what users say about this Riley design

"We are very definitely satisfied with this unit and certainly would not hesitate in installing another bottom of this type."

NORTHERN PAPER MILLS
Green Bay, Wisconsin

Northern Paper Mills are now installing another Riley unit of this design.

"We are so well pleased with this unit that a duplicate unit is now being installed."

HOOKER ELECTROCHEMICAL CO.
Niagara Falls, New York

Hooker Electrochemical have now installed five Riley units of this type.

"We have had no difficulty in cleaning ash from the single header hopper bottom. Ash flows readily down the slope of the hopper."

CENTRAL OHIO LIGHT AND POWER CO.
Bluffton, Ohio

Central Ohio Light and Power Co. has now installed a duplicate unit.

TRADE MARK Rx REGISTERED

RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Washington Buffalo Pittsburgh Cleveland Detroit Chicago
Cincinnati Charlotte Atlanta New Orleans St. Louis Kansas City St. Paul Tulsa Houston
Denver Salt Lake City Los Angeles Portland Seattle

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • ECONOMIZERS

install this unique Riley Boiler Unit

designed for pulverized coal firing

YOU SAVE COST OF SEPARATE HOPPER

Since a water-cooled ash hopper is an integral part of the furnace with this Riley design, by installing it, you not only save the initial cost of a separate hopper but also the cost of hopper foundations and supports as well as future hopper maintenance.

YOU SAVE COST OF HOPPER SEALS

On units requiring a separate ash hopper, seals must be provided between the boiler unit and ash hopper to prevent air infiltration. With this Riley unit, you not only eliminate the difficulties of providing and maintaining positive seals but also the cost of them.

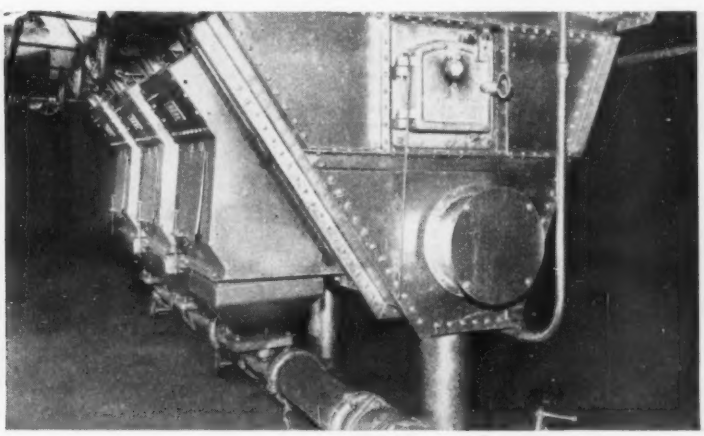
YOU SAVE IN BUILDING COSTS

For a given steam capacity and furnace width, over-all height of the unit is reduced by at least five feet resulting in large savings in building cost if new building is involved or permitting installation or larger capacity units in existing building.

SPONTANEOUS ACCEPTANCE BY ENGINEERS

Thirty-five of the country's leading consulting engineering companies have engineered boiler installations involving Riley units of this type. Engineers have selected this type of unit for over 85% of all Riley pulverized coal-fired installations, purchased since 1948.

Photo below shows Hopper Construction and Ash Conveying System.



Since the first Riley unit of this type was installed in 1946, 137 units have been sold having a steam generating capacity of over 20,000,000 lbs. per hour.

These users have expressed their satisfaction by placing repeat orders with Riley.

Hooker Electrochemical Co.
Celanese Corporation of America
United States Steel Co.
Monsanto Chemical Co.
Esso Standard Oil Co.
Pratt & Whitney Aircraft Corp.
City of Holyoke
Syracuse University
Central Ohio Light & Power Co.
Western Colorado Power Co.
Riegel Textile Co.
Northern Paper Mills
City of Rochester, Minnesota
Cities Service Oil Co.
Dairyland Power Cooperative
Ohio Oil Co.

Other Users

Carbide & Carbon Chemical Co.
Western Electric Co.
Carrier Corporation
Continental Can Co.
South Carolina Electric & Gas Co.
United States Rubber Co.
North American Aviation
General Electric Co.
Goodyear Tire & Rubber Co.
Flintkote Co.
Norton Company
Thomas A. Edison Co.
Colorado Fuel & Iron Co.
White Pine Copper Co.
Chase Brass & Copper Co.
Hanna Furnace Corp.
Calumet & Hecla Consol. Mining Co.
C. H. Masland & Sons
American Viscose Co.
Great Lakes Steel Co.
Bird & Son, Inc.

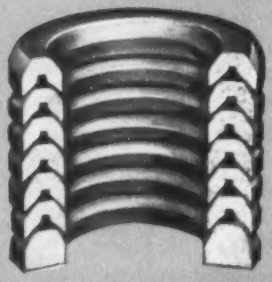
A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs

COMPLETE STEAM GENERATING UNITS

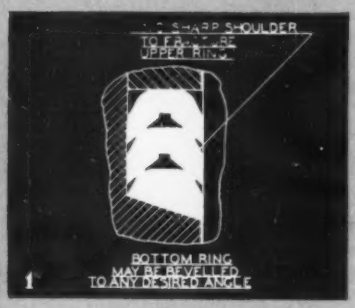
. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

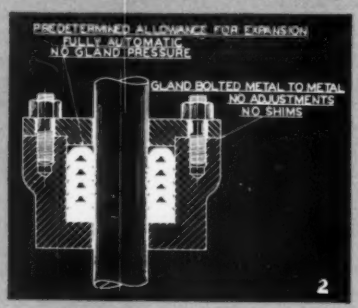
WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

Chesterton
Parachute Packing

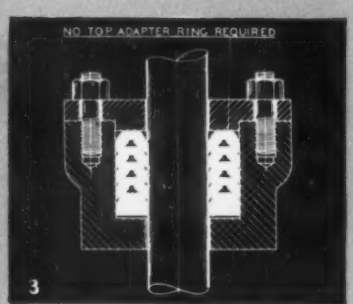


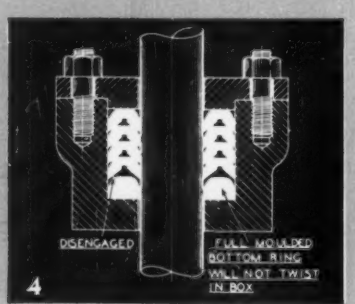
ENDS PACKING PROBLEMS





Parachute is a *fully*-automatic self-lubricating packing which requires absolutely no attention or adjustments after it is installed. It has proven superior for hydraulic rams and rods for all services; oil, steam, water. Because of its automatic features Parachute seals on the pressure stroke only thus guaranteeing twice the service over other V type moulded packings which require constant gland pressure. Due to its unique design, Parachute has individual lubrication retention channels in each sealing ring.





Compare Parachute's full-bodied construction with thin V style rings. Note full-moulded bottom ring with pilot sides which cannot twist in the box. Note that each ring seals as an individual unit and that no special top adapters are necessary as each Parachute ring has moulded flat top surface. Due to its rigid construction and proven service Parachute does not require metal reinforcing rings even on extreme pressures. Order from your nearest listed distributor a trial set to prove to your own satisfaction the trouble-free service received from Chesterton Parachute Packing.

CENTRIFO WON'T SCORE SHAFTS

A centrifugal packing that won't score soft metal shafts or sleeves even at 4,000 r.p.m. Superior to square flax or braided asbestos for hot or cold water, brine or cold oil. Write our old-timer, *Jack Hartley*, about your tough packing problems.

WHERE TO BUY
CHESTERTON PACKINGS

Alabama
Turner Sup., Mobile
Wimberly & Thomas Birm.

Arizona
Geo. S. Thomson, Phoenix

Arkansas
A. S. Kelly, West Helena
McKee-Pitts, Fort Smith

California
Mission Pipe & Sup, San Diego
Victor Belt. & Rub., L.A.
Holz Tire & Rub., Lodi
Valley Pipe & Sup., Fresno
Western Ind. Sup., Sacr.

Colorado
T. R. Stevens, Denver

Connecticut
Lindquist Hdw., Brdpt.
Jackson & Sequine, Hart.
C. N. Flagg, Meriden
Abel Trans., Plainville

Florida
Farquhar Mch., Jacks.
Mine & Mill Sup., Lakeland
Railey-Milam, Miami

Georgia
Pye-Barker, Atlanta
S. Donald Fortson, Augusta
Corbin Sup., Macon

Illinois
Hagerty Bros., Peoria
Brown Auto Sup., Decatur

Indiana
W. J. Holliday, Indpolis
Smith-Monroe, S. Bend
Baker Spec. & Sup., Logansport
M&M Sup Co., Muncie

Iowa
A. Y. McDonald Mfg., Des Moines-Waterloo

Kansas
Crane Co., Topeka

Kentucky
Louisville Mill Co., Louisville
Plumbers Sup., Lexgtn.

Louisiana
Paul, Rice & Levy, New Orleans
Service to Sawmillers, Shreveport

Maine
Hall & Knight, Lewiston

Massachusetts
Fall River Steam & Gas Pipe, Fall River
Holyoke Valve & Hydrant, Holy.
Industrial Sup., Worc.
Robbins-Gamwell, Pitts.
Zina Goodell, Salem
Albert E Mayer, Sprng.

Michigan
Northern Hdw., Menominee
Kenneth Anderson, Detr.
Mfrs. Eq. & Sup., Flint

Minnesota
Goodin Co., Minapolis
Duluth Plumbing, Duluth

Mississippi
John S. Stilley, Jackson

Missouri
Kansas City Rub. & Belt., K.C.
Rubber Prod. Co., St. Louis
Jamieson Mch., St. Jo.

Nebraska
Interstate Mch. & Sup., Omaha

Nevada
Sierra Mch., Reno

New Jersey
Fleck Co., Camden
Mfg. Selling, Trenton

New York
Kasper & Koetzle, Brklyn.
Root, Neal, Buffalo
Burns Piping, Syracuse
Beltran Assoc., N.Y.C.
Colerick Sup., Utica
Geo. H Cole, Troy

North Carolina
Bernhardt-Seagle, Lenoir
Gen. Fdy & Mch., Sanford
Sykes Sup. Co., Burl.
A. Lynn Thomas, Charlotte & Raleigh
Cape Fear Sup., Fayetteville
Citizens Tran. & Coal, Asheville

Ohio
Clark Asbestos Co., Cleveland
Shaw-Kendall Eng., Toledo
Yohe Sup., Canton
Monarch Petr. Prod., Columbus
Focke Rub. Pro., Dayton

Oklahoma
Hart Ind. Sup., Okl City

Oregon
Ken McDowell Co., Portland

Pennsylvania
Perry Mill, Erie
Raub Sup. Co., Harrisburg & Lancaster
E. Keeler Co., Willsport
Bush-Miller, York
Somers, Fitler & Todd, Phila.
Harris Hdw., Kingston
Lehigh Val. Sup., Allentown

S. Carolina
Sullivan Hdw., Anderson
Allen & Webb, Charlstn.
A. Lynn Thomas, Columbia

Tennessee
Nashville Mch. & Sup., Nashville
Browning Belt. & Sup., Knoxville
Pidgeon-Thomas Iron, Memphis
Rogers-Bailey Sup., Chattanooga
Summers Hdw. & Sup., Johnson City

Texas
Zork Hdw., El Paso
Hornsby Heavy Hdw, Wichita Falls
Conroe Mill Sup., Conroe

Utah
Schieren-Jarvis, Salt Lake

Virginia
Barker-Jennings, Lynchburg
A. Lynn Thomas., Richmond & Norfolk

Washington
Titan Chain Saw, Seattle
Jensen-Byrd, Spokane
Paramnt. Sup., Tacoma

Wisconsin
Shadbolt & Boyd, Milw.
Pumps & Equip., Madison

Canada
Gordon-Belyea, Vancouver
Crown Mech. Pkgs., Montreal
John Clouston, St. John's, Nfld.

Hawaiian Islands
P. S. Pell & Co. Ltd.—Honolulu

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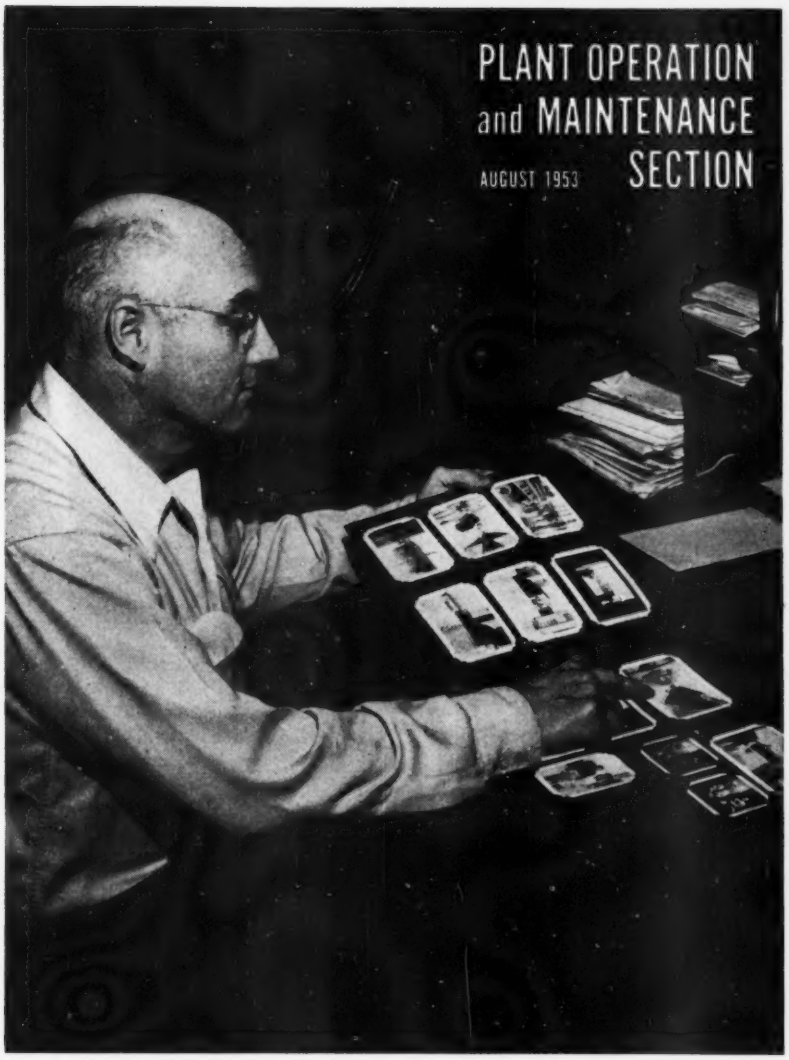
PLUS
Agents in all Foreign Countries

A. W. CHESTERTON CO.
6 ASHLAND ST., EVERETT 49, MASS.

AMERICA'S OLDEST MANUFACTURER OF MECHANICAL PACKINGS



CHIEF ENGINEER Howard Spanganberg shows *Power* editor photo history of his power plant. Photos recall interesting incidents in plant's busy, eventful past

WOODEN PLANKS and clay against the powerhouse openings kept the water on the outside

STUCK SLUICE gate let in 5300 gpm, but the temporary pumps shoved the water back out

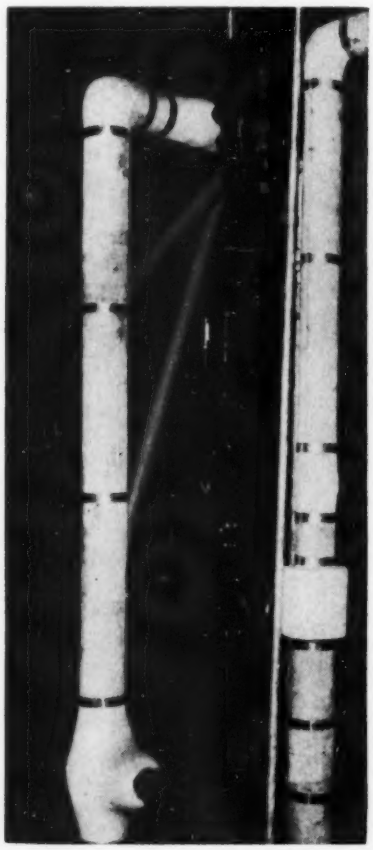
PARTITIONS of iron are now all ready to bolt and gasket into their places in a hurry

Photos Record Plant Growth...
...and Headaches of Chief Engineer

Here's one operating chief who has been keeping a pictorial record of his plant's highlights over the past 25 years. He shoots everything of importance for future reference. For more info, turn page

By **STEVE ELONKA,** *Associate Editor*

TWO-INCH extra-heavy piping is welded at bends to stop vibration in hp lines



SMALLER piping-braces are welded here to hydraulic lines to stop any "shimmy"

SHEET IRON is welded to inside of the slight bends on pipe's opposite sides

► IT'S ALWAYS a pleasure to run into a chief engineer of the old school. Driving through Palmyra, N. Y. recently, I was attracted by the one big smokestack in town. It turned out to be The Garlock Packing Co's power plant.

Inside, I found Howard Spanganberg, who has been chief engineer in the same plant since 1928. He was glad to see a POWER editor because he's been reading POWER religiously all these years. A trip through his plant soon showed me that Howard has a man-sized job. With the firm growing steadily through the years, the manufacturing plants have always demanded more and still more power. About the time one new unit is installed, another is overworked, and Spanganberg's headaches start all over.

At present, a new 100,000-lb-per-hour boiler and a 3000-kw steam-turbine electric generator, complete with condenser, are being installed. A few months ago, two new triplex, variable-stroke, pumps for hydraulic service were installed.

Back in his office I asked Howard to tell me about some problems he's had to solve. That's when he pulled a large, well-filled photo album out of his desk drawer. Album is filled with photos of his associates, interesting repair jobs, and many other things that have taken place in his plant. It was easy to see that his plant and his associates are as important to him as his home and his family.

Flood. "Here's one headache that had us all sweating," said Howard, showing me photos of water around his plant. "We had our first flood in 1942. Then it paid us a return visit in 1950. There was 36-in. of water against our plant wall here when 'Garlock Lake' got rambunctious.

"In '42, we placed large 2-in. planks against all openings around the powerhouse, then dumped truck loads of clay against the planks to seal them. Water came up so fast we had only four hours before it got to our building wall. Then, just as we got to feeling smug about the whole thing, we found water flowing into our cistern inside the plant. Trouble was a faulty sluice gate that we couldn't close. The gate hadn't been closed for some time, and now it didn't work.

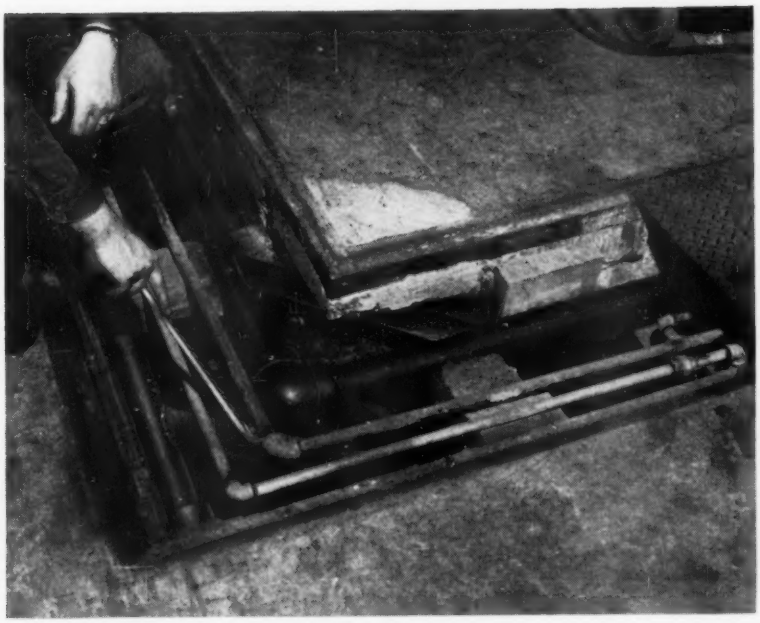
"But we had to keep the plant dry. So we hooked three pumps to the cistern and ran their discharge outside (photo). Three pumps running at full capacity shoved water outside at the rate of 5300 gpm. That just *did* keep water down in the cistern.

"That flood taught us a lesson other plants might profit from," said Howard good-naturedly. "Now we are prepared if the water pays us a return engagement. Our answer is large sheet-iron partitions that fit against the power-plant doors (photo). If a flood should threaten, we can bolt these plates against angle-irons fastened into the brick work at all openings. With a gasket at each joint, there's no danger of water getting in. That's quicker and easier than building wooden walls and hauling clay.

"Take a look at these photos," said Howard, thumbing through his photo album. And there I saw every detail of that event, recorded faithfully.

"Too bad more power engineers don't keep a picture history of their plants," I commented. "That's a mighty valu-

High-Pressure Hydraulic Piping Gave Trouble at 3300 psi Until These Changes Were Made



HEAVY strap iron, welded to 90-degree bends of heavy piping in floor pit, keeps high pressure from straining piping at elbows. This also solved vibration problem

able reference for young engineers coming in here to learn this game."

Vibration Solved. "A few months ago we installed two new variable-stroke, motor-driven, triplex pumps," continued Howard. Each delivers from 0- to 55-gpm water against discharge pressures up to 3300 psi. These pumps are vertical and have built-in, double reduction-geared drive, with motor mounted above on pump frame. Each pump is driven at constant crankshaft speed of 236 rpm. Motors are 125 hp, 1800 rpm, synchronous, having 80% leading power factor. They are excited from external, 125-volt dc power," said Howard.

"Pumps discharge into air-loaded, hydraulic accumulator of 250-gallon capacity. An accumulator shutoff valve automatically isolates accumulator from hydraulic system if any high-pressure piping ruptures. That avoids losing compressed-air charge that loads accumulator.

"These triplex units are in the power plant and supply the many hydraulic presses in the manufacturing buildings. Rams of hydraulic presses are first operated by 180-psi water from centrifugal pumps. Then these triplex pumps take over by driving the rams home at over 3000 psi and holding presses closed while they cure products under high temperature. So only a small amount of water need be delivered by triplex pumps at high pressures.

"These pumps work like a charm," said Spanganberg, "but the piping between pumps and accumulating bottle vibrated so badly we hated to use the pumps. Of course, the manufacturer had told us we might have vibration. On some installations there is no trouble, then on an identical job the vibration may be pretty bad.

"We took the manufacturer's suggestion," said Howard, "and braced the piping." [see photos] "Extra-heavy pipe was welded to each bend from two angles. This keeps the bends from straining when at 3300 psi. It also braces piping against vibration. On unlagged piping, where bends are slight, we welded sheet iron on inside of bends. On larger lines in the floor pit, we welded heavy strap iron, to hold all 90-degree bends together. That not only stopped vibration, but also took most strain off elbows.

"This new high-pressure, hydraulic system replaced old horizontal, direct-acting steam pumps," continued Howard. "The old pumps couldn't maintain needed uniform supply pressure that presses called for. Now pressures are held steady and press operation has greatly improved. Also, maintenance on entire hydraulic system is much less. This is because we don't have excessive pressure pulsations now."

"You know," I said, "this method of bracing may be good insurance where there is the least indication of vibration. It not only prevents pipe fatigue, but also cuts down damage to gages, thermometers and other instruments caused by vibration. And it prevents insulation being shaken off the lines."

Packing. "Out in the plant, I noticed that your pumps and other equipment don't leak around the glands," I said, after looking through the album. "How do you account for that?"

"Of course, we manufacture all types of packing and gasket materials," answered Howard. "Some of my shafts are sealed with our latest mechanical seals. Others with our asbestos packing, or metal foil packing and other types of the many packings we manufacture."

"I'm especially interested in knowing more about mechanical seals," I said. "What's your experience with them?"

"I've found that if the right seal is used for the job," answered Howard, "it does save on maintenance. For example, there is no shaft wear because the seal does not rub the shaft. Instead, a carbon ring seals against a metal ring that's attached to the seals. Seal is attached to shaft on outer end and sealed against housing inside old stuffing box.

"Another advantage is there's no leakage. But a sealing problem is like any other around a power plant, it's a good idea to get expert advice. All in all, I guess that packing problems are about the least of my headaches."

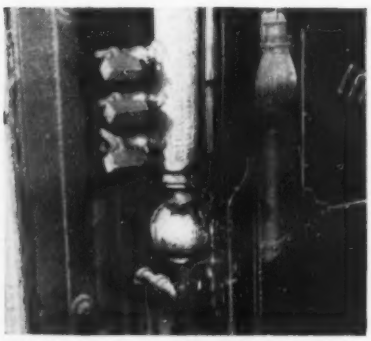
Boiler. Howard told me about losing water-wall tubes in a boiler. He found the ¾-in. holes in the internal feed line in steam drum were turned up instead of down. So phosphate couldn't mix with drum water. But turning feed-line so holes pointed down solved problem.

At this point Chief Spanganberg was called over to the new boiler, so I figured it was a good time to shove off before I wore out my welcome. There were many other improvements to write about, but I'll have to let them go until after the new plant is finished. Howard likes to keep an eye on everything going in.

In leaving, I couldn't help feeling that here was a man who loved his job.

OPERATORS' NOTEBOOK 66

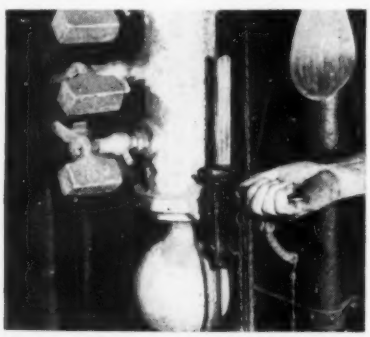
Install Gage Glasses



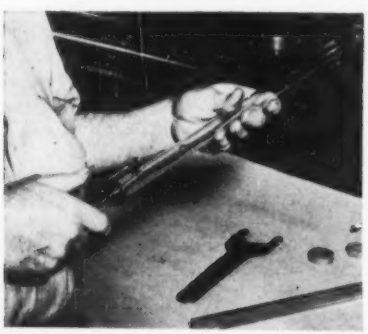
1 Glass thins mostly above water line; also breaks with fittings out of line

2 First shut off top and bottom cocks with chains when the glass breaks

3 Then open drain valve on column that is used for blowing down the glass

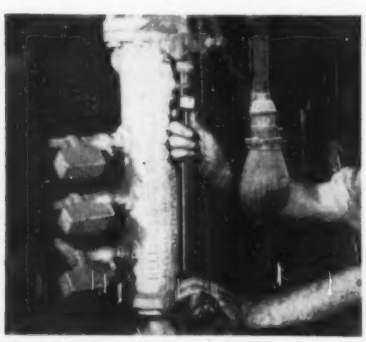


4 Remove broken glass, then open cocks from floor to blow out broken pieces

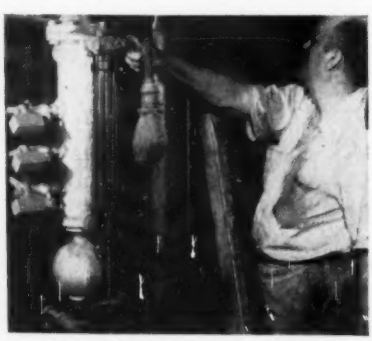


5 Cut glass to right length by revolving between cutters until it breaks

6 Place top washer, and then nuts (not shown); bottom washer; then install



7 Add graphite to washer so nut does not twist glass; hand tighten only



8 Heat slowly by blowing steam at top. Open cocks from floor; close drain

Round Glass

LIKE OTHER CERAMICS, glass is brittle, does not deform before failure. It fractures only from tensile stresses, never from shear or compression. Stress-strain curve is straight line to the breaking point.

Glass has high degree of "notch-sensitivity." Tiny surface scratches, bruises or imperfections cause failure. So be careful when handling gage glasses. Keep them in wrapper until ready to install. If you must put them down, place on soft, clean surfaces.

Glass can be heat-treated to raise its endurance limit. This is known as "tempering." First, glass temperature is raised high, then it's chilled. That sets up residual stresses that are tensile in interior and compressive at surface. And it's at surface where tension usually starts. Tempering also tends to reduce harmful effects of surface bruises and scratches. But tubular gage glasses are not as "adaptable" to tempering as flat glasses.

Corrosion is tough on gage glasses—caused by alkalinity and temperature. Most corrosion (thinning) on tubular glasses is above water line at upper half. Here steam condenses and continually flows down glass, eroding it. Boiler water with pH of 11.5, for example, attacks glass 30 times faster than water with pH of 8.5. That shows importance of low pH if you have glass-thinning problem. Rate of attack from temperature increases 100 times from 265 to 500 F. Solution then is to use flat glass, protected by mica so water does not contact glass.

Of course, water in gage is cooler than water in boiler. Some condensate, formed in boiler connection above gage, flows into gage and lowers alkalinity. This condensate dissolves some silica in glass because of decomposition.

Silica content increases as condensate flows down over glass. Rate of corrosion below water level depends on silica remaining in gage water. Rate of water attack above water level is less as distance increases from top end of glass to bottom. Boiler water, not treated for silica removal, corrodes glass.

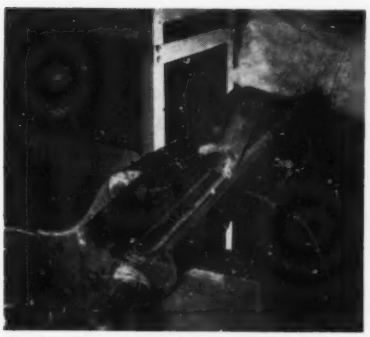
For over 300 psi, it's best to use flat glass, protected with mica. Pressure limits for tubular glass decrease with glass length. Buckling stress is the result of eccentric column loading.

Right for Long Service

By STEVE ELONKA
Associate Editor

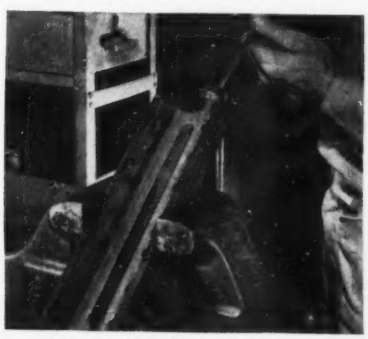
1 Mica, protecting glass from steam and water, turns opaque before failure

2 Remove clamps, glass gaskets, mica. Graphite the threads, run them down



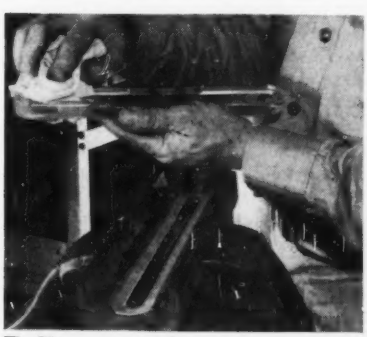
3 Remove old gasket but don't scrape low spots in joint surface of gage

Polish surface perfectly smooth or the tiny high spots will cause failure



5 Clean both ends of gage so scrapings won't plug cocks when back on drum

6 Clean surface thoroughly, oil with molybdenum disulfide so glass slips



7 Place new gasket, mica, new clean glass, another gasket; place clamps

8 Glass mustn't touch metal. Use only molybdenum disulfide on high temp

Flat Glass

ON HIGH-PRESSURE boilers above 1000 psi, there have been many costly gage-glass failures running into thousands of dollars. But fault has been from gage design, as well as from method of installing glass, rough handling and glass imperfections.

At Corning Glass Works, I saw a nail driven into wood with a flat glass. This is possible because high residual stresses push out against the outside high compressive-stress, which was set by tempering. Here are failure causes, ways to prevent:

(1) Never reuse gage glasses. (2) Use special glasses only for high-temperature service. (3) Under extreme pressure, gage metal tends to bulge out, so gage bends if designed poorly—starts a crack because glass won't bend. (4) Scraping gasket off metal raises burr—causing high unit loading. Always polish gage surfaces perfectly smooth. (5) Numerous scrapings to remove gaskets create high and low spots. Level old surfaces. (6) Pulling up unevenly on bolts loads glass unevenly. (7) Asbestos is "lumpy" in gasket, causing high spots. Use only best gasket material.

(8) Many failures occur on high pressures when starting up because glass was not heated gradually. Don't open gage cocks until new glass has chance to heat by conduction. Then crack top-cock only. Also, cool down slowly. (9) Don't blow down oftener than needed. (10) Use two valves for blowing down. Keep one throttled for slow flow through glass, blow with other valve only.

(11) Lubricate contact surfaces of glass with molybdenum disulfide only. This does not crystallize, allows travel between glass and fitting. (12) Don't use cover plate if it has permanent deflection, if it's of poor design, or if clamping-device design is poor. (13) Mica discoloration means that mica has failed and water contacts glass. Don't wait for glass to fail—change it.

High pressures and temperatures in newer boilers (around 2000 psi) bring new problems. Flat glasses are strengthened by tempering, but residual stresses or strain set up may release at high temperatures. Over long periods, glass loses much strength that was added by tempering. So when ordering glass, consider pressure and temperature.

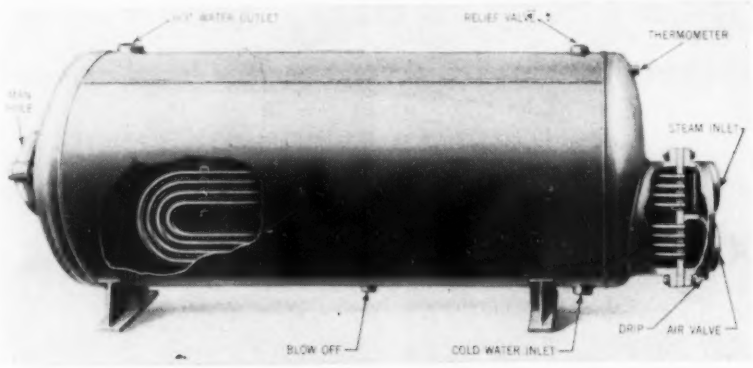
APPLICATION CHECKS

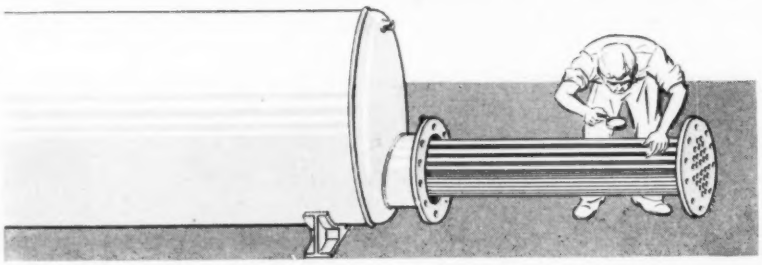
HEATER SHELL must be flange-quality steel, at least ¼ inch thick. Have the equipment design meet the *ASME Pressure Vessel Code*

LINING material has to resist corrosion, hold up under operating temperatures. Whatever you choose for liner service—cement or copper—know that it's applied right, is free of cracks and bulges, has right thickness to withstand temperature, pressure change

OUTSIDE. Be certain you give the hecter a good insulating coat—at least 3 inches of 85% magnesia block, troweled over with cement

TUBE BUNDLE must be made up of hard copper with a support of softer metal, usually brass. Annealed copper used for the tubes in the bundle will develop sags





HORIZONTAL hot-water storage heaters are a natural where water demands are not constant, nor continuous. With proper controls they give the desired temperature

Lick Your Storage-Heater Problems

By F P LANKOW, *Patterson-Kelley Co*

► THE HOT-WATER STORAGE HEATER enjoys a basically simple design. With this start in life, you can look for and should get long, troublefree service. Problems you run into usually result from poor application, improper materials or faulty selection of auxiliaries like traps, check valves, thermostatic temperature-regulating valves.

Horizontal storage heater, photo above, is the most common design. All it consists of is a shell and a removable heating section, made up of a nest or bundle of copper tubes formed into a horizontal U- or hairpin-shaped element. The lower you can spot a coil into this shell, the better the heater performance. Here's why:

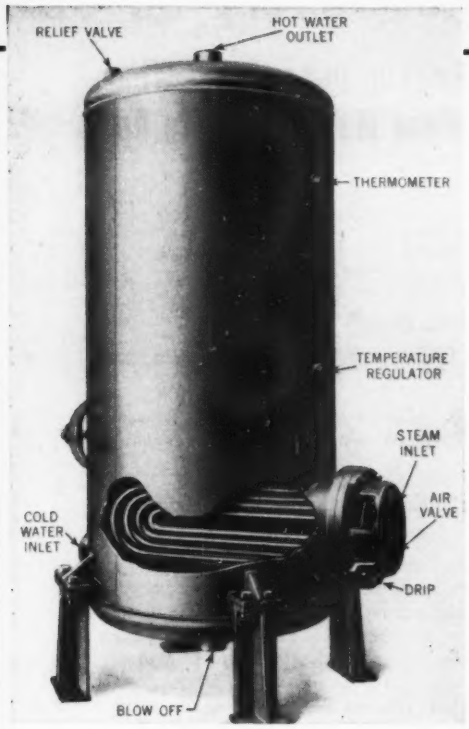
When unit is operating, cold water enters the shell beneath, but preferably very close to, the tube bundle. It picks up heat from the tube surfaces and then natural convection currents take over. Cold, denser water by sheer weight shoves aside and replaces warmer, lighter water, and soon the hottest water appears at top of shell. The ideal place to draw off hot water is at this level and that is exactly how it is done, photo above. So, with a tube bundle set at lowest practical point in the shell, you supply heat where you need it most—to coldest water.

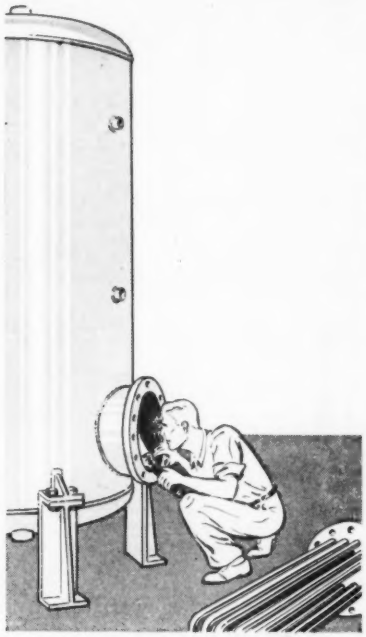
This tube bundle in itself presents special engineering problems. As you could expect, you want steam and steam alone to enter the coil. Then you must be sure any condensate that forms in the bundle gets out as fast as possible. These jobs should definitely be part of the original engineering. They entail an understanding of right trap size, value of a vacuum breaker, and so on. These auxiliaries and their problems could make an article by themselves. For the time being, let's stick to the heater.

Heater Application. Any plant where hot-water demands are not constant and continuous is a natural for a hot-water storage heater. Where demands are sudden, and you've a heavy process or heating load as well, these heaters are vital to good operation. With them you can pull a relatively small, steady steam supply and heat a large volume of water over a period of time. With proper controls, such as a thermostatic temperature-regulating valve, you can hold this water at almost any temperature. What's more, with the right-sized storage you should never have to put any strain on boiler output.

Installation follows these basic rules: (1) Put in hot-water storage heater with its steam supply and return lines as short as possible, even at the expense of extending your water lines. (2) Mount heater as high as possible. (This gives a substantial head to receiving tank and a good hydrostatic head on trap.) (3) Be sure heater supports are solidly set.

Over and above the simple rules above are these expected precautions: (1) Check that heater is absolutely





VERTICAL storage heaters work best where the floor space is tight, the head room plentiful. Tube bundle is very short and permits easy handling and maintenance

MATERIAL HIGHLIGHTS

PIPING. Make steam supply and return lines as short as possible. If steam line has to be long, put in traps before going into the heater

MOUNT heater as high as possible to give a substantial head on the receiving tank, plus a good hydrostatic head on the trap. Be sure the heater's supports set solid. See that it is exactly level. You may have to brace the support legs to prevent sway

OPERATION. Blow down a few gallons from the mud-blow every morning, surely once a week, to keep the heating coil free of dirt accumulations

MAINTENANCE. Drain and examine heater interior every six months for first few years, once a year thereafter. Check lining and tube condition, bundle support

By Proper Application, Auxiliaries

level. (2) See that insulation is applied —at least 3 in. of 85% magnesia block troweled over with cement. (If heater is exposed to the elements, give it an additional canvas-duck covering, several coats of paint. Be sure, though, you leave nameplate of heater exposed.)

Proper Materials. Heating element, or coil, should be hard copper (for example, 1¼-in. OD, No. 16 BWG seamless drawn copper tubing, mill tested to 1000 psi with just the bends annealed at time of fabrication). It's our experience that soft or annealed tubing sags between supports shortly after going into operation. These sags cause pockets to form; condensate collects in them to upset heater operation.

But usually you find no severe problems from tubing materials. More often than not, it's additions and attachments to the heater that act up.

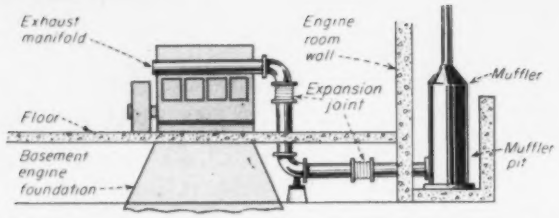
The shell may be of many different substances—carbon steel, copper silicon, stainless steel—and supplied, for steel, with special linings of copper, aluminum or cement, depending on the application. Steel is by far the most widely used shell material. It should be flange quality, of sufficient thickness (never less than ¼ in.) to allow for corrosion, usually fabricated in keeping with *ASME Pressure Vessel Code* (par U-69). But, even so, nagging corrosion and electrolysis problems keep cropping up.

Avoid Electrolysis. It's never good practice to install a steel shell and hook it up with nonferrous piping, particularly when hot water circulates through a system and back through the heater. What you've got is just like a big storage battery with the steel shell as one terminal and the dissimilar nonferrous piping as the other. The water acting as an electrolyte, gets better each time it moves around the system. Pretty soon inside surface of steel shell is plating off fast.

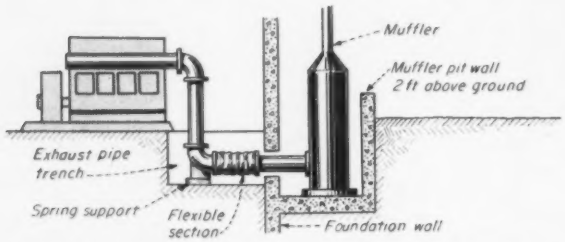
We've run into heaters suffering from this cause. If you catch them soon enough, putting in a cement lining salvages them. Often this answers another complaint—rusty or red water.

There are definite limitations, though. Never use a cement lining where storage temperatures above 180 F are considered. Cement tends to break down at temperatures above this point. Copper linings or copper silicon prove better materials for this service. The silicon compound has the tensile strength of steel combined with high corrosion-resisting properties. It works particularly well with solutions that have a corrosive action commercially pure copper cannot withstand.

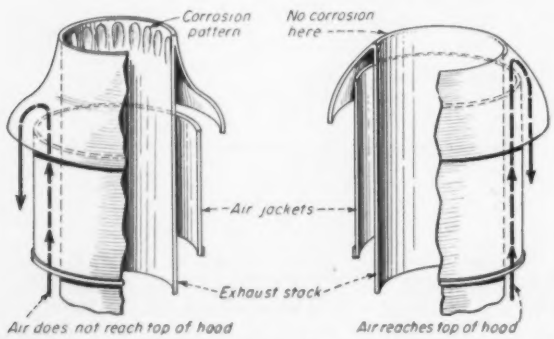
Copper lining, properly installed, with seams electrically welded and the lining extended to nozzle and manhole openings, gives excellent service. By spinning the copper lining into tube holes and expanding the tubes against this lining you get watertight joints, a further operating advantage.



1 If there's a basement, taking exhaust piping through it keeps engine room uncluttered. Muffler is in pit outside



2 Plant without basement has exhaust pipe in trench. Note flexible section to absorb vibration, and spring support

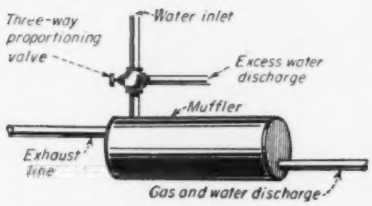


3 Hood on exhaust line corrodes if not built so the air goes all the way to the top, as shown in the sketch at right

Don't Forget Your Diesel Exhaust Lines

Tail end of diesel plant is often overlooked. But here C Morgan Jones tells how to install and maintain your exhaust lines from engine's manifold right up to the very top of the stack

Hookup Depends On What Your Muffler Has To Do



4 Small engines sometimes use a "wet" muffler. Always watch water pressure

► A POOR EXHAUST system can cut engine output, raise noise level, and let you in for expensive repairs besides. See how your present system checks against some of the pointers that follow. And when you put in a new engine, make sure exhaust system does the job.

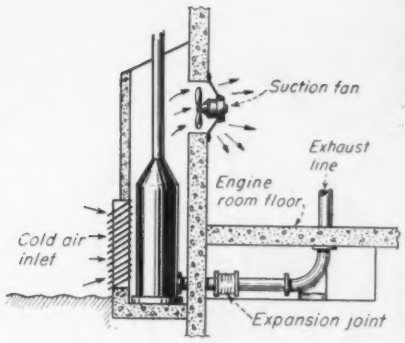
Short and Sweet. The best exhaust line is the shortest. That's because pressure drop in the line puts backpressure on the engine, cuts its capacity. So keep it short, with fewest possible bends. Use long-radius elbows and bends wherever you can. Make sure pipe diameter is ample—next larger size usually pays.

Expansion. No matter how the exhaust line runs, it's going to expand when hot gas flows through it. This necessitates expansion joints or flexible sections to take up expansion and to help absorb engine vibration. Finally, support weight of line properly.

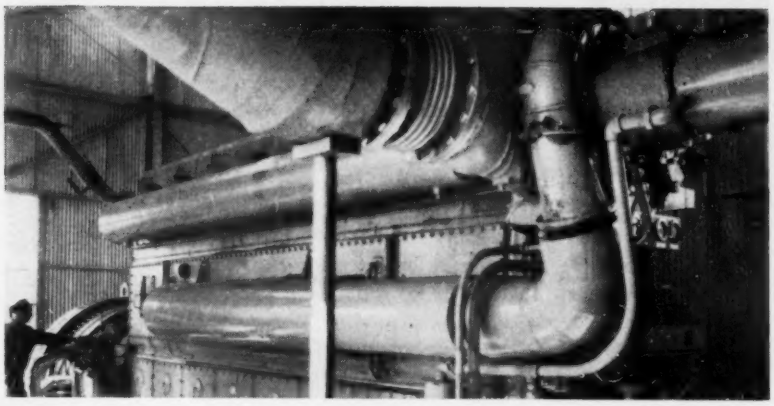
Where expansion is taken and how line is supported depends on how it's run. In simplest case, line runs from manifold through building wall to a muffler mounted on a concrete or steel base outside. A single flexible section and support may do the trick, Fig. 6.

Basement Layout. To keep engine room clear, exhaust line is often run under operating floor, either in a basement or in pipe trenches. Fig. 1 shows a basement hookup. Note support at elbow for weight of exhaust system, expansion joints to take movement in both vertical and horizontal directions.

Pipe Trench. If there's no basement under engine room, carry pipes in a trench if possible. Just any ditch won't do. Carry pipes in level-bottomed trenches about three to four times as deep as pipe diameter. Line trench with concrete, about 1-in. thick and support pipes with suitable blocks. With pipes in position, fill trench with dry sand tamped lightly in place. Cover with one



5 To heat engine room, fan pulls warm air through louvers, around muffler



6 Exhaust line for this engine is built for good service. The flexible joint absorbs engine vibration. Note the substantial support, which takes pipe weight

inch of cement and level off with floor.

Weld or braze pipes to eliminate as many joints as possible. Where joints must be made, mark a cross in wet concrete to show position. This will save a lot of grief when you have to find a leaky joint at some future date. Place any valves in boxes to blank off small areas from sand. Cover with removable plates or gratings.

Muffler Pit. Fig. 2 shows exhaust pipe in a trench leading to a muffler in a pit outside the building. Spring support under elbow carries line weight, takes any vertical expansion.

Pit is lined with concrete. Steel plate under muffler serves as track for muffler rollers. But expansion joint or flexible section in horizontal run is still a good idea because vertical expansion might "cock" pipe, keep rollers from moving freely.

To keep such an outdoor pit from being flooded, install a large drain. It's also good practice to extend pit walls about 2 ft above ground level.

Lag exhaust lines, like the vertical ones in Figs. 1 and 2, that are within reach. And it's always a good idea to color-code piping, tag any valves.

Stacks. Extend tail pipes or stacks upward from muffler, 6 to 8 ft above roof (see local codes).

If stack is air-jacketed, make sure jacket runs up to the very top, as shown at right in Fig. 3. This stops corrosive damage by keeping exhaust gas from condensing on the cooler unjacketed stack. Water in the exhaust often absorbs sulfur. Acids so formed run down stack, eat away metal.

Exhaust stacks sometimes serve more than one engine. If they do, make sure gas from operating unit can't enter idle engine through open valves. Once in cylinders, exhaust gas may set up corrosive conditions. Pipe connections to stack so it's easier for gas to flow out of stack than into engine. Or install butterfly valves to blank off idle engine.

Manifold Cracks. Exhaust manifolds get hot and may crack. Crack advertises itself by exhaust gases leaking into engine room. If jacketed lines crack, water can enter the engine cylinders. This may crack heads, bend connecting rods, etc.

If manifold is water-cooled, always bar engine over with indicator cocks open before starting. This shows if water has leaked back into a cylinder. Engine might run normally with a slight crack in manifold, but after it's stopped, crack widens as metal cools. Then water may seep into cylinders through open exhaust valves.

Such cracks are hard to find in engine. Only practical method is to give manifold a hydrostatic test.

If you must run engine with a crack, expel all water by barring over. Then give engine the air and start it quickly. When manifold is hot enough, crack may close. Water that does go through shoots up stack as steam.

Cleaning Jackets. Cracks come from rapid temperature changes, scale inside manifold jackets and tightening manifold nuts unevenly. Scale is often worst offender. So descale when cleaning engine water jackets. First remove manifold end-plates, if fitted, and rake out loose deposits. If cooling water is very hard, manifolds may need frequent cleaning.

Clean by blanking off inlets and outlets. Circulate a good scale solvent, then wash thoroughly. If no plugs on water side of manifold, drill and tap holes. Circulate cleaner through manifold with a small pump.

Cracks in unjacketed manifolds can be welded or brazed. But if they are subjected to high temperatures, have repairs done by expert. Temporary repairs can be made by "sewing" the crack with studs, but these often burn out quickly.

Silencers. Engines usually need silencers to meet local requirements. Select one that doesn't throttle the exhaust. Throttling effect builds up backpressure and places extra load on the engine. Today's mufflers are scientifically designed, based on acoustic principles.

If your engine is supercharged, turbine of supercharger may itself act as a silencer. Then, depending on engine and locality, you may need only a spark arrester.

There are both dry and wet mufflers, but dry type is most general in stationary plants. Operating engine at idling speeds for long periods may lead to soot deposits—a fire hazard. Worn pistons cause oil pumping. Then leaky exhaust valves help silencers soot-up.

Clean dry-type mufflers often. Open drains or hand doors when cleaning. After muffler traps are opened and all loose carbon removed, stick a compressed-air lance inside to help break off and remove heavy accumulations. At same time lightly tap muffler shell.

Rattle in silencer outlet is from loose end plates or split seams. Bad corrosion, if everything else is OK, means fuel has high sulfur content.

Heat Recovery. Waste-heat boilers often exert some silencing effect. Where good silencing is needed, use one of the available combination mufflers and heat-recovery units. Some waste-heat pickup can be gained from a muffler alone, if rigged as in Fig. 5.

A poor exhaust system can cut engine output, raise noise level, and let you in for expensive repairs besides. Some operators overlook the importance of this system until it is too late. Go over your exhaust system carefully and make changes if it was not installed according to best practice.

Refrigeration Trouble Shooting

By C T BAKER, *Atlanta, Georgia*

1 With mounting power bills, the manager blamed his troubles on utility firm's "fast" meters

"You guys are robbers," wailed the ice plant manager. The power company came back, "Your plants are haywire." And that's when Mr Baker was called in to act as the referee

► FEUD BETWEEN the general manager of a group of ice plants and the power company brought me into the picture. Row was about cost of electric power. Ice company's executive claimed his power bills were out of reason. Power company maintained that if ice plants were put in order, the kw consumption per ton of ice produced would be much lower.

Ice company's general manager asked me to make a complete check of his plants and to submit a report. Before undertaking the job, ice people told me they were certain that all power company's electric meters were "fast." So they squawked about being gypped.

Since they insisted meters were faulty, my first step was a check-up test of the electric meters. For this I used a rotating standard, which had been checked against a precision wattmeter. I made tests in the presence of power company engineers. Here are results:

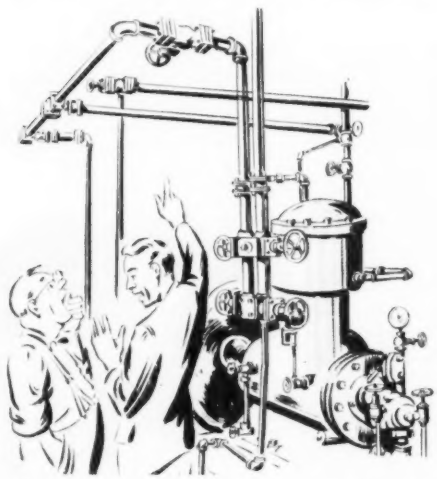
Plant	*Full load*	*¾ load*	*1/10th load*
A	1.6% fast	1.6% fast	Correct
B	1.1% fast	1.1% fast	2.7% fast
C	0.9% slow	0.8% slow	3.0% fast
D	0.8% fast	0.7% fast	0.6% fast
E	0.6% fast	0.3% fast	0.8% slow
F	0.6 % slow	0.53% slow	0.65% slow

These tests showed power company's meters were not seriously wrong. So I continued the investigation to find if there were any "fifth columnists."

Secondary voltage delivered by power company, at entrance switch of each plant, was shown to be correct—namely, 550 volts.

Plant A had a total of 345 hp in motors installed. Largest was a 275-hp synchronous motor, which operates at unity power factor.

I found that none of the low-temperature ammonia piping was insulated. Check on suction gas-temperature entering compressor showed a super-heat of 40 F, with a suction pressure of 19-psi gage. Compressor was a twin-cylinder, horizontal, double-acting type, operating at 150 rpm.



3 No insulation on suction lines of refrigerating compressors wasted power in all six plants

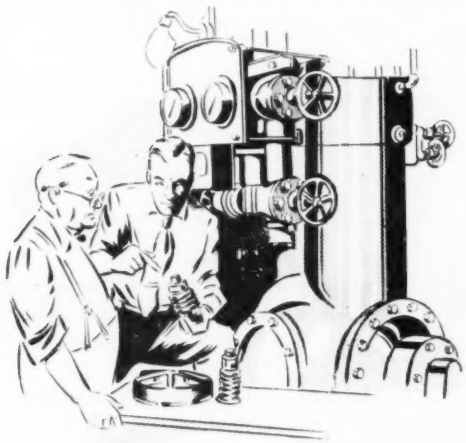
Next, indicator cards were taken from each compressor cylinder. On these I plotted the adiabatic and isothermal curves. These showed badly leaking suction and discharge valves and piston rings. Because the compressor was large, 12-in. diameter by 24-in. stroke, leaking valves and compressor rings, both for compressor output and power consumption per ton of ice produced, indicated a serious situation.

During the winter shutdown, this compressor was opened for inspection. My indicator card analysis was proven correct. All suction and discharge valves were leaking. Rings of one cylinder were worn so badly they permitted considerable blowby.

Plant B had a total of 670 hp in motors. Largest was a 350-hp synchronous motor, operating at unity power factor. Next in size was a 200-hp motor of same type.

Indicator cards taken from each cylinder of each compressor showed badly leaking discharge valves. Discharge temperatures in some cases were close to 300 F. Suction superheat was as high as 50 F. Ammonia condensers had not been cleaned during the ice season and were badly fouled. Suction-line insulation had deteriorated so badly it was completely useless. And only because it had not been maintained.

2 Meters were first checked with rotating standard that had jibed with a precision wattmeter



4 Indicator cards had shown the compressor discharge valves and piston rings leaked badly

Plant C. This plant had only one compressor, driven by a 75-hp synchronous motor. Neither the cylinders nor the mercury wells on the suction-inlet and discharge-outlet connections at the compressor were equipped for taking cards. Therefore, I couldn't make a complete check on compressor performance. High condensing pressures were noted, however. This condition came from poor cooling-tower performance.

Plant D. Here again, badly leaking valves and pistons were causing loss in capacity. Power cost per ton of ice produced was very high.

Also, an over-charge of ammonia had filled the liquid receiver. So liquid backed into the shell and tube condenser. This partly explained the high condensing pressure, 220 to 225 psi.

Plant E had two compressors, each driven by a 150-hp synchronous motor, also one smaller unit driven by a 75-hp synchronous motor. Only one unit of this group, a 12x18-in., horizontal, twin-cylinder, double-acting machine, was equipped for taking cards. When the cards were developed, they also showed excessive valve and piston leakage.

Discharge-gas temperatures from this machine were 275 to 285 F. Low ammonia charge in system prevented freezing coils from being completely flooded for best results.

Two suction-pressure gages were giving misleading information. For example: One gage read 20 psi, when actually pressure was only 12 psi. Other gage indicated 18 psi, when actual pressure was 12 psi.

Effect upon capacity of these compressors, because of faulty suction-pressure gages, is better understood if examined in light of absolute suction pressure.

Suction Pressure. It's well-known that compressor's capacity depends on the pounds of gas it will handle in a given time. And weight of gas handled depends on efficiency of compressor, also on pressure at which gas is delivered to compressor. As weight of gas varies with absolute suction pressure, it follows that the higher the absolute suction pressure consistent with temperature carried in freezing tank, the greater will be the compressor capacity. Therefore, a compressor operating at 30-psi gage pressure will have about 50% greater capacity than when operating at 15-psi gage pressure.

Pressure gages in ice and refrigerating plants often show false pressures. If it is a suction-pressure gage, this can be very serious, as shown in Plant E.

Curious thing about the group of plants in these case histories is that a large sum of money had been spent on improvements and repairs during the previous winter. Yet power costs were considerably higher the following summer.

New chief engineer took over at beginning of next winter. He put the compressors in good condition. Cylinders were bored and fitted with new pistons and suction and discharge valves. New pressure gages were installed, and all gages were provided with snubbers to dampen out pulsations generated by the compressors.

Results. Following season's operation told a different cost story. Prior to complete overhaul of compressors and other changes made by the new chief engineer, average kw consumption for all plants was 103 kw per ton of ice produced. This figure dropped to an average of 65 kw per ton after revamping program was completed. This was a drop of 38 kw per ton and a reduction of slightly over 47c per ton in power cost.

Summary. The abnormal power consumption in these cases was from failure to maintain compressors properly, also from inaccurate instruments for gaging their performance. Stated more plainly, it was result of ignorance, laziness and indifference.

Engineers in ice and refrigerating plants should have thermometers on compressor's suction inlet and discharge outlet. Then they can quickly detect abnormal conditions, such as high discharge-gas temperatures resulting from leaking or broken discharge valves. Immediate steps can then halt trouble.

Also, thermometer on condenser liquid outlet serves to check condenser performance. This is valuable in preventing trouble. For example, pressure gage on condenser's gas inlet should indicate a pressure very close to that corresponding to temperature of liquid leaving condenser. If not, look for noncondensable gas in system.

Exception to this rule of pressure-temperature relationship is in a condenser so made that it subcools liquid a little before reaching receiver.

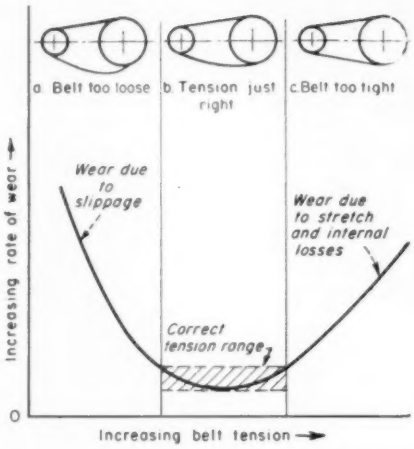
It costs very little to protect pressure gages against damage from pulsations. Providing thermometers on condenser's water inlet and outlet, to check on dirty tubes and drop in condensing water volume for any reason, also costs little.

When properly used, a good foul-gas purger, (there are several on the market) will maintain system free of noncondensable gas and save power.

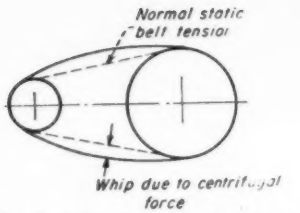
Demand for ice is going down, year after year. What more reason do ice firms want for holding production costs as low as possible? Why not get best results from your plant?

Here are fundamentals back of today's most popular variable-speed drives:

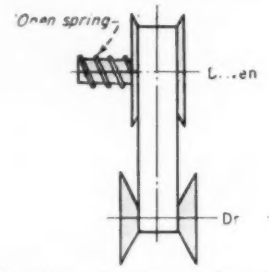
- **How torque is transmitted**
- **Why manufacturers rate their units conservatively**
- **Why efficiency improves from low to rated output**



1 Belt tension must fall in a narrow range for long life, maximum power transmission



2 Centrifugal force robs belt of useful load-carrying strength



3 Cone pressure against belt changes with speed variation

Mechanical Variable-Speed

► To UNDERSTAND operation of variable-speed transmissions, we need to know the theory behind them. Here are four fundamentals of the currently popular variable-cone transmission: *driving force, speed-torque relationships, unit ratings, efficiency.* See parts II and III for commercial applications of this principle in use today.

Driving force in any belt system is the difference between tensions in tight and slack sides of the belt. For maximum life and transmission effectiveness tension must be just right, Fig. 1. If belt is too loose it will slip, increasing wear and power loss. If too tight, extra stress causes heating, fatigue and wear. Power is wasted, belt and bearing life shortened.

Initial tension limits the maximum force that can be transmitted, so most transmissions incorporate some arrangement for "loading" the belt or chain. The loading device can assume any one or a combination of several forms: a spring-loaded variable cone; a spring- or weight-loaded floating belt tensioner; pressure on belt cleat reinforcements; adjustable base, spring or floating pulley to increase center distance and add direct pull.

As speed changes, three factors affect maximum belt tension: (1) arc of contact, sometimes called the angle of wrap (2) centrifugal force (3) pressure of cone faces against belt.

Arc of contact affects both ends of the speed-torque curve, Fig. 5. The smaller the arc of contact (less wrap), the lower the friction force between belt and cone or pulley. Pull is reduced.

Centrifugal force, Fig. 2, affects only the high-speed end of the speed-torque curve. It varies as the square of speed. Hence, a stress of but one unit of centrifugal force at 800 rpm would increase to nine units at 2400 rpm—a speed change of only three to one. Centrifugal force becomes an important factor at 3000-fpm belt velocity, and at 5000 fpm it becomes the controlling factor.

This force is independent of pulley diameter. It depends entirely on belt velocity. A belt traveling 3000 fpm over 10-in. pulleys is subject to the same centrifugal force as one traveling 3000 fpm over 20-in. pulleys.

There are two ways that centrifugal force is detrimental—first, it imposes stresses that rob the belt of useful load-carrying strength, and second, it throws belt outward from its normal driving path, reducing arc of contact. Full torque cannot be transmitted.

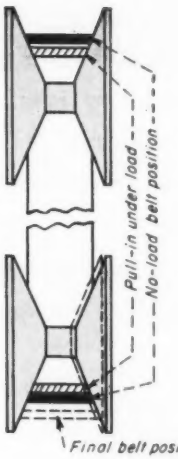
Pressure of cone faces against the belt decreases at low speeds, Fig. 3. On some transmissions, movement of the variable cones reduces spring compression. On others the center distances are modified, thus lowering belt tension. In either case, torque transmission at low speeds falls off.

Speed-torque relationships. Maximum output torque, Fig. 5, is the product of varying driving tension and changing driven-cone radius. At low speeds, *A*, torque droops due to decreased cone pressure on belt or to shift of belt position. At high speeds, *B*, centrifugal force causes droop.

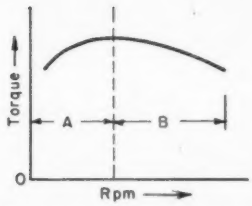
Fig. 6 shows performance of a typical variable-cone drive (transmission with motor). At output speeds less than rated motor speed, belt limits torque transmission. Above full-load motor speed, motor limits torque.

To protect the transmission against heavy starting loads, shock and overload, manufacturers rate their machines conservatively as shown on the "rated torque" curve. Such ratings create a constant-torque illusion. But variable-speed transmissions are fundamentally torque converters, and torque can increase from rated to pull-out values as output speed decreases.

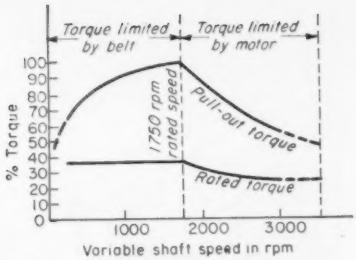
Unit ratings. Most commercial transmissions are rated for moderate service conditions—8 hr per day, non-shock,



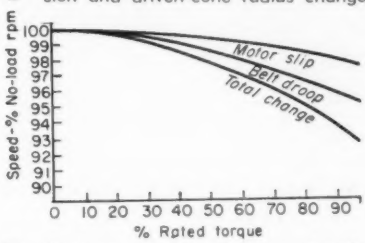
4 Belt "pulls in" when unit transmits a high torque. Speed ratio changes



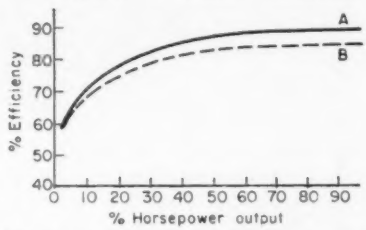
5 Maximum output torque varies as tension and driven-cone radius change



6 Manufacturers' torque rating is conservative, to protect transmission



7 As torque increases, the speed ratio is changed, sometimes as much as 7%



8 Typical efficiency values are essentially flat from 50 to 100% output

Transmissions: IV

By W L BYLER, *North Wales, Pa.*

infrequent starting and stopping. Next month we'll discuss a way to evaluate manufacturers' ratings.

Tests show that wear on belts and cone faces is fairly constant if drives are rated as constant-torque machines up to 1:1 speed ratio, Fig. 6, and constant-power above 1:1. The machine doesn't actually behave as a constant-torque transmission. It is only rated that way. Considering a variable-speed unit as a constant-torque machine will often lead to trouble in the plant.

In rating their units, manufacturers consider at least three other factors:

(1) All mechanical variable-speed transmissions are necessarily a design compromise with limitations like torque and speed sensitivity, limited accuracy in speed duplication, limited strength of the lubricant used.

(2) Speed ratio changes due to the torque transmitted, Belts and chains may pull-in to a smaller cone diameter when torque is high, Fig. 4. Such deviations usually reduce operating speed, thus preventing exact speed control. This causes an output speed variation from 2 to 7% below catalog ratings when the transmission is operated with locked controls, Fig. 7.

On the rigid-type transmission, using metallic cones and rings, increased torque loading may reduce output speeds due to sliding between cone and ring. Driving forces are ordinarily carried by an oil film between ring and cone—much as a journal is carried on its bearing. When torque demands are increased beyond some maximum, the oil film ruptures and direct metal-to-metal contact occurs. At this peak torque, output speed can actually fall to zero, so the torque-speed droop can range from 1 or 1½%, when properly applied, to 100% on severe overloading. Overall operating performance is similar to the variable-cone type, as shown in Fig. 7.

(3) Speed ratio changes due to input speed variations. Under a constant-torque load, a change from low to normal input speed may produce a downward ratio change. This is usually less than ½ of 1%.

Efficiency. Having considered the major variables affecting operation, let's consider five principal losses affecting efficiency:

(1) *Belt losses.* Rubber and cords create friction as the belt stretches and flexes. With chain drives, there is flexing and surface friction of laminations. On ring-and-cone drives, friction is due either to excessive pressure or viscosity of the lubricant used.

(2) *Entering and leaving losses*—caused by friction between belt and sheave, or chain and radial slotted cone face. This is not slip.

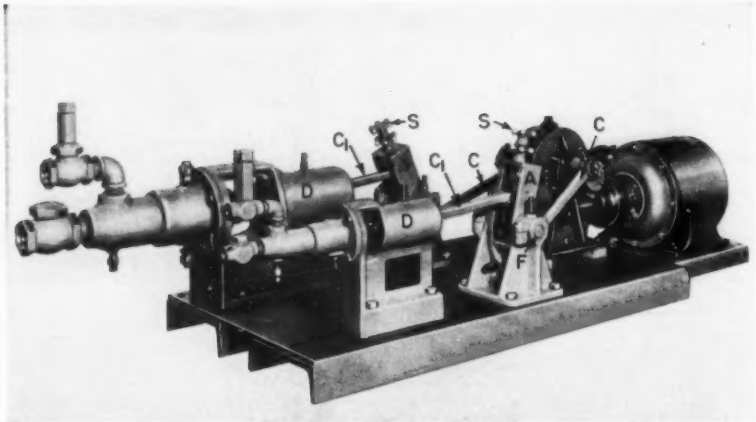
(3) *Windage*—created by ribs or fins on cones, velocity of belt, rotating cone carriers, etc.

(4) *Friction*—in bearings, floating belt tensioner, etc.

(5) *Miscellaneous*—friction of gears or other driving elements, heat losses from rotating parts churning through oil reservoir, etc.

These transmission losses are essentially constant. They do not change much with changes in speed or load. Fig. 8 is a generalized efficiency curve for a belt-driven variable-cone drive and an all-metal ring-and-cone drive. It illustrates the general characteristic pattern for these machines. Actual values may be somewhat different for a given machine. In fact, they will change for two identical machines doing different jobs or operated at different input speeds. Always review these points carefully with the manufacturers before purchasing or putting a transmission in service.

Lower efficiency at lower output is due to constant losses being a larger percentage of power output. This is especially true at low operating speeds.



1 Motor-driven duplex proportioning pump. Discharge rate is adjusted at screw S while pump is running. Pressure ranges to 6000 psi, capacity up to 45 gpm

Here are several more pumps for proportioning jobs in all types of power and industrial plants. This article, second in a series of two, will help you round out your knowledge of these important pump units

By F A ANNETT
Contributing Editor

More Proportioning Pumps for Flows From Drops to Gallons

► THE LAST PUMP we studied in our July article, Fig. 6, p 117, had to be stopped for stroke adjustment. Where capacity adjustments must be made often without stopping pump, you can use mechanism in Fig. 1, above.

A motor drives a duplex unit's crank through a worm gear. Rod *C* connects to the lower end of rocker arm *A*, fulcrumed at *F*. Connecting rod C_1, from pump's crosshead, is attached to a crosshead in rocker arm *A*, and can be positioned by screw *S*.

When connecting-rod block is at top of arm *A*, pump's plunger in cylinder *D* has maximum stroke and discharge. Moving connecting-rod block down until its center coincides with that of fulcrum *F* reduces piston stroke and discharge to zero.

Since screw *S* swings through only a small arc it is easily adjusted to change pump output. Units of this type run at either 48 or 58 strokes per minute for pressures to 6000 psi, capacities from 0.05 to 45 gpm.

Meter Control. Pump in Fig. 2 is connected into a treating circuit and operated from a control meter in the main pipeline. It may be driven by compressed air, water or steam, which is piped to control valve on meter. Valve is a piston type, moved back and forth by meter-registering mechanism. It runs pump at a speed proportional to flow in pipeline.

Treating fluid flows from tank to pump suction and is discharged into pipeline. Operation is similar to unit in Fig. 2, July POWER, p 116.

During time a given quantity of liquid passes through meter, the piston in control valve moves; say, to the left. In this position, valve admits pressure fluid through pipe *P* to left end of pump's operating cylinder. Operating piston and pump plunger move to right, liquid flowing into pump cylinder from treating-fluid tank.

As flow continues through main line, meter moves control piston to right, admitting pressure fluid through pipe P_1 to right-hand end of pump operating cylinder. Pressure fluid is returned through pipe *P* to control valve *D*. From valve it passes to waste or to a sump. Piston now drives pump plunger to left, forcing the charge of treating fluid into the main line.

With this setup, a given quantity of treating fluid is delivered to the main line, while a predetermined quantity of untreated fluid passes through meter. Flow through meter may be variable or constant—it makes no difference. Amount of treating fluid delivered by pump is adjustable to any desired value from maximum to zero by screw *S*. This screw limits pump stroke, and has a scale, indicating pump discharge. Two or more pumps can be run from same meter, each pump discharging a different treating fluid into main.

Hydraulic Displacement. Stroke length and discharge quantity are hydraulically controlled in pump in Fig. 3. Cylinder *C* runs in guide *G*. Piston *P*, connected to pump plunger P_1, is free to move in cylinder *C*. Two ball suction valves, *V*, and two ball discharge valves, V_1, are used. Cylinder *C* supports right side of driving crosshead *H* in guide *G*; C_1 supports left side in G_1.

Stroke length of plunger P_1 is fixed by amount of fluid trapped in cylinder *C*, controlled by valve V_2. Valve control arm *A* pivots at *F*, being pushed down to open V_2 by adjustable sleeve *B* on volume-adjustment screw *S*. Crank-disk pin *E* drives pump's plungers.

In position shown, pump is on full suction with stroke-control valve V_2 held open against tension of spring *T* by arm *A*. Cylinder *C* fills with hydraulic fluid (oil) from the reservoir through suction valve V_3. Chemical-pump cylinder also fills with chemicals handled.

When crankpin starts driving cylinder *C* ahead, piston *P* and plunger P_1 remain at rest because oil can discharge from cylinder *C* through valve V_2. When cylinder and control valve reach the

point where arm A clears sleeve B, spring T closes valve V_2 and traps the remaining fluid in cylinder C. This acts as a solid to drive chemical pump's plunger forward for the remainder of the stroke. Collar L prevents piston P from coming out of cylinder C so plunger P_1 returns to same starting point regardless of stroke length.

Volume-adjustment screw S extends through pump's casing, allowing easy change of stroke while pump runs. Lube oil serves both as hydraulic fluid and driving-mechanism lubricant. This pump is single-ended but double-ended units are also available with independent stroke adjustments for each end.

Stroke-length adjustments are 0 to 3 in. for all designs. Plunger diameter ranges from 1 to 3 in.; maximum capacities are 5 or 10 gpm, depending on whether unit is single- or double-ended. Discharge pressures range to 5000 psi with standard liquid ends, 25,000 psi with special ends.

Diaphragm Pumps. Variable-displacement diaphragm pumps may also be used for proportioning service. Discharge is easily controlled.

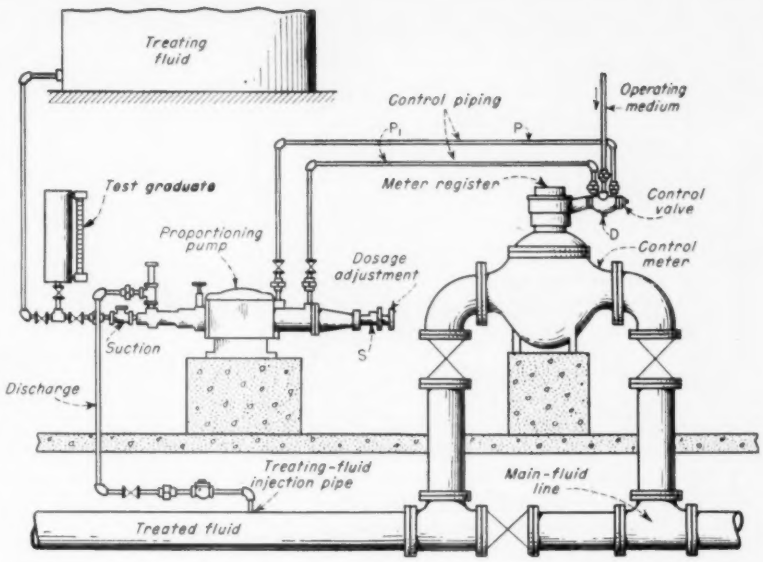
Fig. 4 shows one design of a diaphragm-plunger chemical feeder. Nipple N screws into one end of a cylinder of a reciprocating water pump. Diaphragm D isolates the chemical feeder from the water pump and drives plunger P. Plunger connects to driving head A, held against diaphragm by spring S. Ball suction and discharge valves V and V_1 are spring loaded.

Pulsations from water pump's pressure stroke drive diaphragm D to left. It pushes plunger P to discharge chemicals through valve V_1 into the water line. During suction stroke of water pump, diaphragm and plunger move to the right. Pressure drops in chemical-pump cylinder and a new charge enters through suction valve V to be discharged on next pressure stroke of water pump.

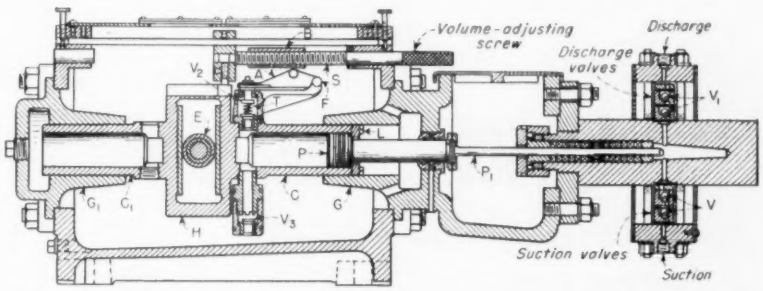
Because diaphragm has an area larger than plunger, this unit develops high pressures, even when water pump runs at only medium pressure. Pump feeds a measured quantity of chemicals on each stroke cycle of water pump, but quantity cannot be adjusted.

Other Methods. Our two articles have shown just a few of the many methods you can use to feed chemicals into pipelines or boilers on a proportional basis. These give a good general idea of the pump types and their applications.

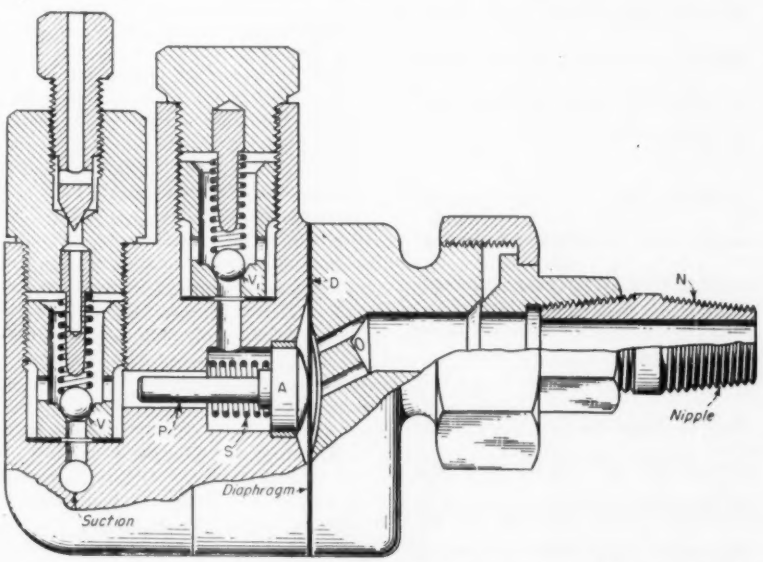
On some systems a constant-delivery pump discharges through a volume controller, actuated by a meter in the main flow line. Treating solution not passed to flow line by volume controller goes through a relief valve, back to treating pump's suction or its supply tank.



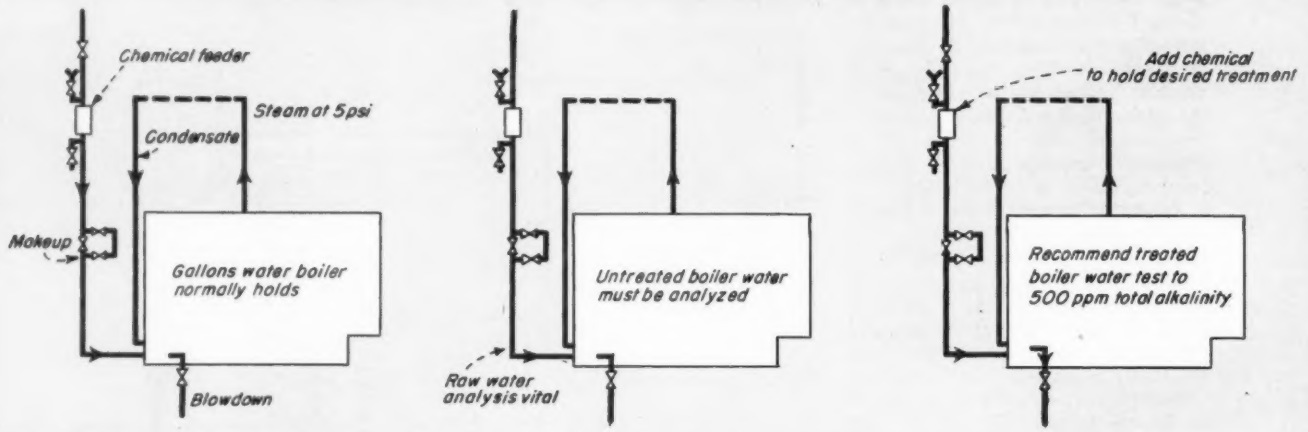
2 Proportioning pump suitable for compressed-air, water or steam drive. Here it is connected in a chemical-treating circuit. Main-line meter controls it



3 Stroke length and discharge of this proportioning pump are controlled by an adjustable hydraulic drive in the crosshead of the unit. Note control valve



4 Diaphragm-plunger-type chemical pump attaches to one end of the water cylinder of a reciprocating pump. It is driven by pressure pulsations in main pump



1 Water quantities the boiler holds, condensate it gets back are needed

2 High boiler losses, high makeup mean you must know analysis of raw water

3 Chemical dosage you add is aimed at maintaining a calculated safe level

Water Treatment for Low-Pressure

By LEO I PINCUS, *Asst Chief Engr, Water Service Laboratories, Inc*

Common Water Problems In Heating Systems

CORROSION — Major cause is dissolved gases. Cure: proper alkalinity control

SCALE—Major cause is high-hardness water. Cure: water treatment, phosphates and organics

CHEMICALS — Background data are needed on water quantities involved, operating practices. Then call in an expert

MAINTENANCE — Constant check-up of system. Requires periodic tests, a follow-up, and then a quick and accurate correction

► TREATING WATER in a low-pressure boiler represents no particular problem. There are, though, certain special factors that can upset your efforts. The more you know about these factors, the better you handle them. Then by applying the proper treatment chemicals you can look for a long, satisfactory boiler life.

Corrosion ranks as the major problem in low-pressure heating systems. Within the boiler you recognize its presence by the uneven eating away of the boiler metal surface. And, appropriately, the name given to this action is pitting. The metal used in making your heating boiler plays a big part in how it reacts to this pitting. Steel boilers, for instance, corrode more quickly than cast-iron designs under the same water and operating conditions.

Commonest causes of corrosion and pitting are the dissolved gases, oxygen and carbon dioxide. Oxygen is the major offender or, as the chemist calls it, the quantity factor. Carbon dioxide acts like the accelerator. It speeds up the process.

You can cut down the damage these gases do by adding enough alkaline salt to neutralize all the CO_2 and leave a hydroxyl alkalinity of about 100-350 ppm as $CaCO_3$; see Table I.

Scale formation can prove the major problem in hard-water areas, or where steam condensate losses are heavy. Then treat the boiler just like a high-pressure design. (Editor's note: See "Proper Water Treatment for Packaged Boilers," P. Brindisi, POWER, June 1953.)

Makeup and Blowdown. Low water makeup and blowdown represent only a minor part of the job of treating a low-pressure heating system's boiler water. Usually all the steam is condensed and returned with the exception of a little loss through the radiator by evaporation. Too heavy a blowdown as a planned part of water-treatment program is silly. For water like New York City's Catskill supply, blowdown ought to run about 5% of makeup. That is, for every 20 in. of water you add to the boiler, you should blow-down one inch.

With an arrangement like this the initial chemical dose to a low-pressure boiler should be based on the gallons the boiler normally holds. Any later doses can and will be small and at infrequent times.

Water Losses. You may, of course, lose a sizable amount of your treatment chemicals if your boiler suffers from too much leakage. Major causes for a heavy water loss from a heating type boiler are:

1. Too heavy a blowdown because the operator has been given wrong info, or does not know better.

2. Auxiliary-equipment failure, like an automatic float getting stuck, so too much fresh water pours in and blow-

Date	Boiler			Blow-down Inches	Makeup Inches	Alk Pt Ppm	Alk MO Ppm	Cl Ppm	Lb Dose	Remarks
	On	Off	Empty							

4 Records, properly set up and kept up to date, help you to hold desired safe level, and to spot any unusual losses

Table I: Common Alkalies for Water Treatment

Common Name	Formula	% Na_2O	% SiO_2	Amt/1000 gal to raise alkalinity 500 ppm as $CaCO_3$
Water glass	Na_2SiO_3	8.9	29	9 qt
Sodium metasilicate	$Na_2SiO_3 5H_2O$	29.2	28.3	8.8 lb
Soda ash	Na_2CO_3	58.0	——	4.5 lb
Trisodium phosphate	$Na_3PO_4 12H_2O$	16.3	——	16 lb

Table II: Form Sheet for Boiler-Room Survey

1. **Equipment Data**
   - a. Purpose of the equipment
   - b. Condition of the equipment
   - c. Data to determine capacity of equipment in gallons
   - d. Auxiliary equipment
   - e. Chemical-feeding equipment
2. **Operating Data**
   - a. General: pressure, temperature, blowdown, fuel consumption
   - b. Flow measurements or methods of estimates
   - c. Troubles considered to be due to water
3. **Chemical Reactions**
   - a. Untreated-water experience
   - b. Previous water-treatment results

Heating Boilers

down has to be heavy to prevent flooding.

3. Start-up troubles do develop where initial steam condenses, hangs up in the system through faulty trap action or poorly pitched return lines. Water has to be added to hold the boiler water level. But later on the hung-up condensate flows back and the boiler floods.

4. Tankless hot-water-coil leaks, which pump fresh water direct to boiler side, making blowdown requirements heavy.

5. Return-line leaks, either from faulty fittings or active corrosion.

Treatment Chemicals. The most widely used conditioning chemical for low-pressure heating boilers is sodium silicate or mixtures containing other alkalies and sodium silicate. You'll find it marketed as a liquid or a solid, Table I. In addition, soda ash and trisodium phosphate plus the alkaline sodium chromates enjoy considerable popularity for this form of water treatment.

As an ideal low-pressure heating-boiler water condition we recommend a hydroxide alkalinity of 100-350 ppm and a total alkalinity of 300-500 ppm, both expressed as $CaCO_3$. We believe alkalinities a little higher than 500 ppm will do no harm. In fact, you can go up to 1000 ppm with safety.

Sodium silicates not only help reach this desired alkalinity level but also form a uniform chemical film over the boiler metal surfaces to combat corrosion. But before adding any chemical you must know how much you need.

We feel the first step in deciding how much chemical you need is to collect the facts on a form like Table II. Then go to a set of sketches, Fig. 1-3. The lead-off sketch, Fig. 1, carries the highly important information of how much the boiler holds under normal conditions. If the boiler is tight, makeup and blowdown should cause no problems.

If there is no appreciable loss of boiler water you need not give Fig. 2 more than a passing glance. If losses run heavy, then you have to know as much as you can about your raw or makeup water. One way of checking on the changes that this raw water makes in your boiler is to know how it is made up chemically. A chemist provides these data in the form of an analysis. A comparison of the chloride contents in the raw water with that in the boiler water indicates just how fast the salts are building up in the boiler water.

With this information in hand you can judge better the effect of boiler losses or the need for blowdown. Suppose we have a concentration factor of 20—that is, there is 20 times as much chloride in the boiler water as in the raw-water makeup—as a normal condition. When boiler losses or a change in raw-water chemical composition develops, the factor changes too. If the factor is higher it means the blowdown schedule has to be increased. If it falls off, you either need less blowdown or you are losing more water through boiler leaks.

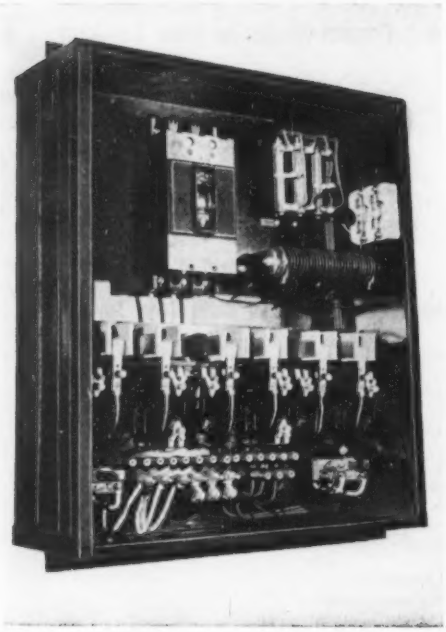
A comparison of the alkalinities between raw and untreated boiler water shows whether you need chemical treatment. It is sometimes possible that a raw water runs alkaline enough so you need no boiler treatment.

To keep corrosion well under control you need to hold alkalinity at the levels we mentioned earlier, 100-350 ppm for hydroxide, 300-500 ppm total alkalinity, both expressed as $CaCO_3$. Any mixture or any one of the chemicals in Table I gives this desired level. The initial dose, which you can pick off from Table I, is based on the number of gallons your boiler holds.

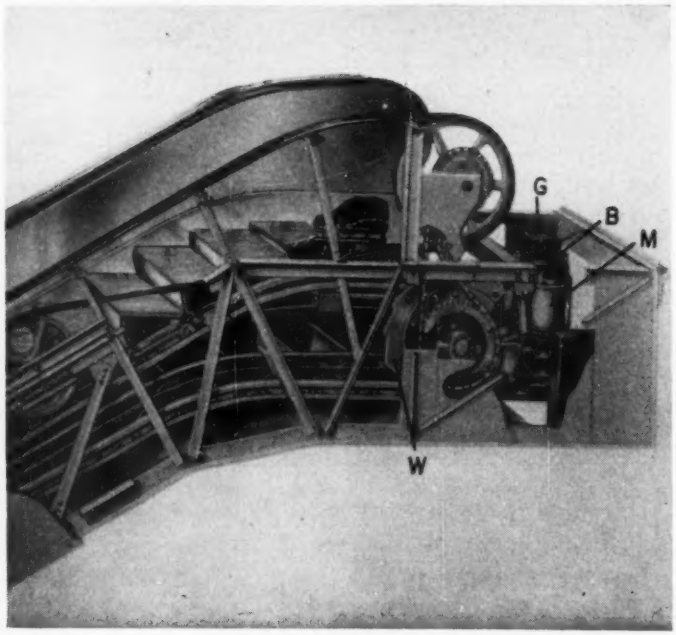
Once you get the right alkalinity level, hold it there continuously for full protection. This means a set of records to guide you, such as Fig. 4, and a regular alkalinity-testing procedure. Fall in alkalinity should be gradual. To counteract it add a proportionate amount of a full charge. The exact amount you are to add is simple to figure out.

As an example, a simple schedule adds a full charge of chemical to the boiler water if total alkalinity gets below 200 ppm, and a half charge if its total alkalinity tests out as more than 200 ppm but less than 500 ppm.

If alkalinity readings drop within a short time, look for heavy water losses.



1 Across-the-line-start control for an electric stairway that's driven by squirrel-cage motor



2 This power end of an electric stairway is driven by a vertical squirrel-cage motor *M*, also a worm-and-gear through a roller-chain drive

Get Moving Stairways Off

To understand how stairs operate, you must know their motor controls. So let's look at two starting methods: (1) across-the-line (2) primary-resistance

By F A ANNETT
Contributing Editor

► A MOVING STAIRWAY is a slow, medium-friction, medium-inertia, constant-speed load, and therefore, can be driven by a normal starting-torque motor. Where ac is available, and it generally is, the motor is often a single-speed across-the-line-start squirrel-cage type. Three-phase squirrel-cage motors, with all six winding leads brought for star-delta starting, are used extensively, as is primary-resistance starting on the larger stairways.

Two-Speed Motors. On some applications where the stairway operates at a higher speed during certain periods, 2-speed squirrel-cage motors are used. On high-speed operation the stairway runs 120 ft per min, and on low speed 90 ft per min.

Compared to elevator-motor controls, those for moving stairways are simple. They are usually key-switch-start type, arranged to readily reverse the power unit when necessary and actuate an electric brake. A feature of these controllers is the large number of safety devices that protect passengers and equipment against about every operating hazard.

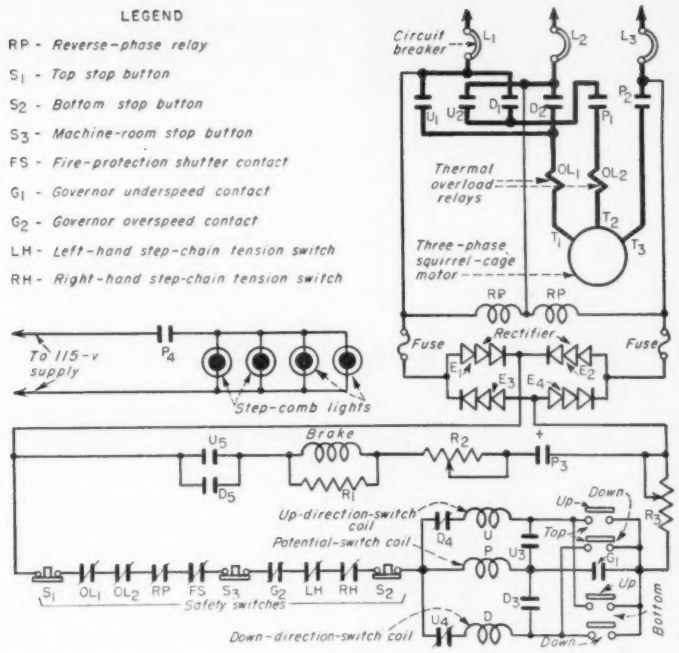
Power-Drive Unit. Fig. 3 is a wiring diagram of a Westinghouse Type L-1 controller, Fig. 1, for an electric stairway driven by a vertical power unit (POWER, April, p 122). It is designed for mounting in the top-end section of the truss close to the stairway at *M*, Fig. 2. This unit is powered by an across-the-line-start, 850-rpm, 10- or 15-hp, squirrel-cage motor mounted directly on a worm-and-gear.

A sprocket on the worm-gear shaft connects by roller chain to the step-chain-sprocket drive shaft of the stairway. A service brake *B* is mounted above the motor with an underspeed and overspeed governor at *G* above the brake. In addition to the service brake, an emergency one is mounted on the top step-chain sprocket assembly. This brake is applied mechanically by a pawl that drops into a ratchet wheel *W* if the drive chain should break—which it never does.

Wiring Diagram. At top of wiring diagram, Fig. 3, are the motor, its direction- and potential-switch contacts. The motor is protected by thermal overload relays OL_1 and OL_2 and a reverse-phase relay *RP*. A contact *RP* for the latter is in the safety-switch circuit at the bottom of the diagram.

Below the motor is a selenium-disk rectifier that supplies dc for all control and service-brake-coil circuits. This rectifier connects without a transformer direct to the 220-v motor-power supply. Consequently, its dc voltage is always higher than the 115-v required for the brake and control circuits. Excess voltage is absorbed in variable resistor R_2 in the brake-coil circuit and R_3 in the direction- and potential-switch-coil circuits. These resistors permit adjusting the dc voltage to a correct value, whether the motor operates on 208 or 220 v, and also compensates for any decrease in dc voltage due to aging of the rectifier.

Safety Contacts. Four step-comb lights, two for each terminal, are shown



3 Straight-line diagram of electric-stairs across-the-line-start control. Direction-switch contacts above motor, reverse-phase relay *RP* below

To a Good Start

at the center of the drawing, separate from the control circuits. The lamps light the approach to the steps at each terminal, operate from a 115-v power supply, and are controlled by contact P_4 on the potential switch P.

Most of the safety contacts are shown connected in series in lower left hand of the drawing. Purpose of each of these contacts is given in the legend in upper left. In lower right are the top and bottom starting-switch stations. These switches are key operated, and are generally located in the newels or on a nearby column. To start the stairway a key is put into the switch, turned to the start position, and held there until the stairway reaches a speed where the governor underspeed contact G_1 closes, at about 80% rated speed.

Starting the Stairway. Assume the stairway is to start in the up-direction from the top terminal. At this station, closing the up-switch completes a circuit from + on the rectifier through R_3, the up-switch, up-direction switch coil U, all the safety-switch contacts to − on the rectifier. This coil closes contacts U_1 and U_2 in the motor circuit, contact U_5 in the brake-coil circuit, U_3 between coils U and P. And the coil opens contact U_4 to break the circuit through coil D.

When contact U_3 closes it completes a circuit through potential-switch coil P, which closes contacts P_1 and P_2 in the motor circuit, and P_3 in the brake-coil circuit. The latter is now complete through contacts P_3 and U_5 so the brake releases. On one line polarity the motor circuit is also complete from, say, line L_1, contact U_1, the motor, contacts P_1 and U_2 to line L_2. The other circuit is from L_3 through P_2, the motor, and to line L_2 as before. Motor starts and when stairway is running at about 80% rated speed, governor closes its underspeed contact G_1 to bypass start switches.

A circuit for coils P and U now goes directly from the rectifier through contact G_1 without going through the top up-start switch so the starting key can be returned to neutral and removed. The stairway will now continue to run until one of the stop buttons S_1, S_2 or S_3 or a safety switch opens. Once the stairway slows down and the governor underspeed contact G_1 opens, it cannot start again except by using the key to close one of the start switches. This prevents the stairway from being started except under absolutely safe conditions.

Reverse Direction. Starting the stairway in down-direction is the same as up, except that either of the down start switches is closed. This completes a circuit through down-direction switch coil D that closes contacts D_1 and D_2 in the motor circuit, D_5 in the brake-coil circuit, and D_3 in the potential-switch coil P circuit. From here, starting operations are the same as for up-direction, except current direction is reversed in motor leads T_1 and T_2.

Resistance Start. Fig. 3 is about the simplest form of a moving-stairway control. For the larger sizes of electric stairways, type *S*, Westinghouse uses a primary-resistance-start controller. This control is used with a power unit similar to that on a horizontal-shaft worm-and-gear-driven elevator, except it is designed for electric-stairway service.

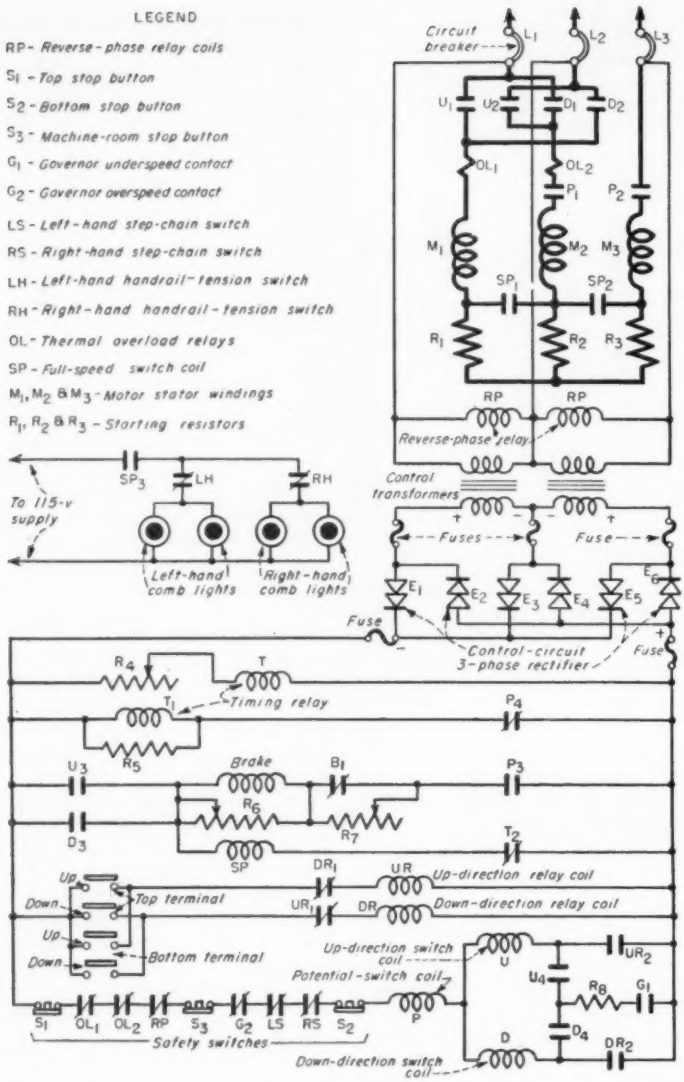
Fig. 4 is an elementary wiring diagram for a type *S* stairway's motor control. Even though arranged somewhat differently it has many features similar to Fig. 3. At top of diagram is the up- and down-direction switch contacts U_1, U_2, and D_1, D_2. Below these are the thermal overload relays OL_1 and OL_2, and the potential switch contacts P_1 and P_2. Then, come the 3-phase motor windings M_1, M_2 and M_3 that connect to starting resistors, R_1, R_2 and R_3. These resistors are cut out of circuit by closing contacts SP_1 and SP_2.

Connected to the 3-phase line is a reverse-phase relay *RP*, as in Fig. 3, and two control-circuit transformers grouped open-delta. These transformers have six sets of terminals (not shown) brought out on them that permit operating on 199-208 to 550-575 v circuits. They provide the correct voltage for the 3-phase copper-oxide rectifier, E_1 to E_6, that supplies dc to the brake-coil and control-circuits.

Assume transformer polarity as shown, then current flows down from + on the transformers through rectifiers E_2 and E_6 to the right-hand fuse. Current flow continues through the control circuits and up through rectifier E_3 and to − between the two transformers. When the center transformer tap is + current flows from it through rectifier E_4 and the control circuits as before, through rectifiers E_1 and E_5 to the transformers. Even though current flows reversed in the transformers the rectifiers kept it in the same direction in the control circuits.

Timing Relay. Below the rectifier is the timing relay with coils T and T_1 that control the time when resistors R_1 to R_3 are cut out of the motor circuits. Coils T and T_1 of this relay are connected directly across the rectifier. As long as both coils are energized, con-

(*Continued on page* 122)



4 Simplfied wiring diagram of primary-resistance-start control for single-speed squirrel-cage motor driving electric stairs by roller chain

tact T_2 in speed-coil SP circuit is open.

Brake Coil. Next comes the brake-coil circuit. Resistor R_6 shunts this coil so, when its circuit is opened to apply the brake, the coil discharges through this resistor. This action causes the brake to apply easily to bring the stairway to rest smoothly and without shock. Resistor R_7 is shunted by closed contact B_1, which connects the brake coil directly across the line for a quick positive release. When the brake releases, contact B_1 opens to put resistor R_7 in series with the brake coil to reduce the current in it to a holding value.

Parallel with the brake-coil circuit is coil SP that closes contacts SP_1 and SP_2 to cut starting resistors R_1 to R_3 out of the motor circuits for full-speed operation. Closing of these contacts is controlled by timing-relay contact T_2, as previously mentioned.

Starting Switches. At bottom of diagram are the stairway, terminal starting switches, the direction-switch coils, and the safety switches. These are practically the same as in Fig. 3, but are not arranged the same. In Fig. 3 the direction and potential-switch-coil current is handled directly by the start buttons. Because switches are heavier in Fig. 4, their current is handled by relays UR and DR in series with start switches.

Control Operation. Assume that the stairway is to start in the up-direction from the top landing. At this station the starting key is put in the switch and turned to the up-start position, which closes the top up-switch. A circuit is completed from + on the rectifier, through coil UR, contact DR_1, top up switch to − on the rectifier. Contact UR_1 opens in the down-direction relay DR coil circuit to lock this relay open. Relay UR also closes contact UR_2 in the up-direction-switch U coil and potential-switch P coil circuit. This circuit is from + on the rectifier, through contact UR_2, coils U and P in series, the safety switches to − on the rectifier.

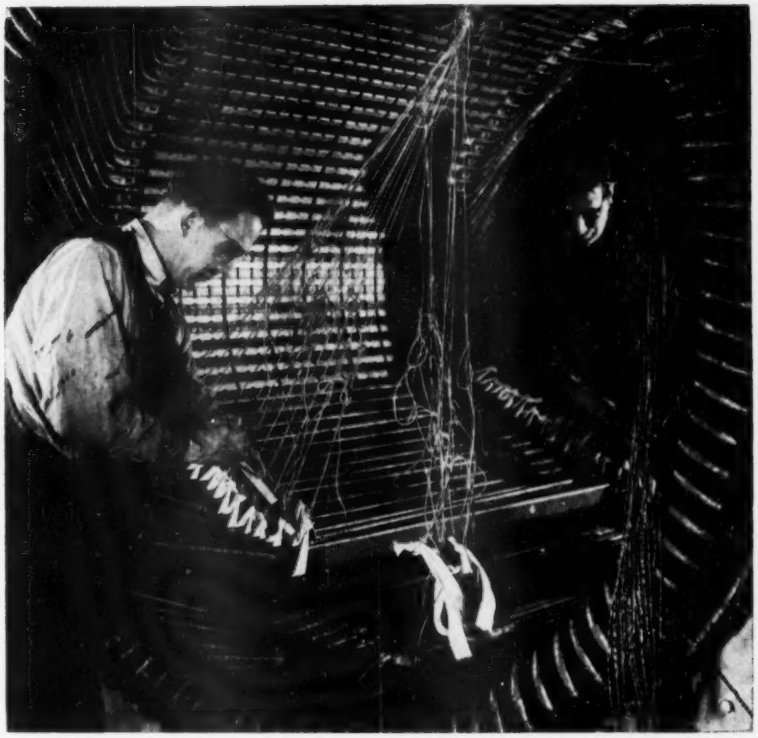
Several contacts close and others open at the same time. Contacts P_3 and U_3 close in the brake-coil circuit to release the brake and let the motor start the stairway. Contacts U_1, U_2, P_1 and P_2 close to complete the motor circuits and it starts with resistors R_1, R_2 and R_3 in series with its stator-windings.

Coil P opens contact P_4 in timing-relay T_1 coil circuit, and this relay starts timing out. After a given time this relay closes contact T_2 in the accelerating-switch coil SP circuit. This coil closes contact SP_1 and SP_2 between resistors R_1, R_2, and R_2, R_3 to cut these resistors out of the motor circuit and bring the stairway to full speed. When the stairway reaches about 80% speed the governor's underspeed contact G_1 closes. This completes a circuit for the direction- and potential-switch coils U and P through contact U_4 that closed when U contactor coil was energized. The circuit is now directly from + on the rectifier through contact G_1, resistor R_8, contact U_4, coils U and P, the safety switches to − on the rectifier. The start switch can now be released, and the stairway remain in operation until one of the stop buttons or safety switches is opened.

On this control, as in Fig. 3, the comb lights are on a separate 115-v ac circuit. These lamps are lighted when contact SP_3 is closed by accelerating-switch coil SP. In series with each pair of lights is a slack handrail contact LH and RH. If either of the handrails gets slack, its switch opens to put out the comb lights and show that the handrail needs attention.

Other Controls. Haughton Elevator Co also uses primary-resistance starting with a contact in parallel with each resistor to start its moving-stairs driving motors. On escalator single-speed 3-phase motors, Otis Elevator Co brings out the six winding leads, and connects the windings in star for starting, and then in delta for running in the up-direction. In down-direction the motor windings remain connected star for both starting and running operations. The Peelle Co uses across-the-line starting for the motors on its motor-stairs.

Will Class H Insulation Pay Off On Motor Rewinds?



TEMPERATURE ADVANTAGE of Class H insulation may justify slight additional cost

► THE ELECTRICAL SIDE of today's central station stands somewhat apart from the average industrial-plant installation. Top reliability is a must with equipment in essentially 24-hr service. Years ago, to get the required reliability, most central stations leaned on duplicate equipment.

This duplication was adopted on the mechanical side, too, with large amounts of spare capacity in boilers and prime movers. Sure, this spelled out reliability—but at a cost prohibitive today. One way of getting the same electrical results today is with modern insulations.

Today's Insulations. Motor winding insulation falls into one of three groups; Class A, B or H. The major difference is the maximum temperature each can withstand safely. The lowest is Class A, 105 C. Next is Class B with a working top of 130 C. And finally, the newest addition to the insulation family, Class H, rated for 180 C.

As was practice in the Charles Pfizer Co (see POWER Feb 1953, pp 107-112), Consolidated Edison Co of N.Y. has pretty much adopted Class H for motor rewinds. But Class H, although boasting a higher temperature advantage, is not the panacea for all motor ills. The problem of mechanical erosion of insulation by cinders and flyash is still unsolved. Right now it looks as if a resilient rubber-like coating may be the answer.

Class H Costs. Con Edison experience points to about the same labor costs regardless of insulation class. Here are some cost differences based on percentages of total motor costs: For open motors, Class A insulation generally tallies about 30% of total motor cost, while Class H comes closer to 35%. With totally-enclosed units, expect to pay 15% for Class A and about 18% for Class H.

Speaking of motor enclosures, Con Edison has justified the additional cost of totally-enclosed fan-cooled motors on the basis of greater reliability and reduced maintenance. Then to top this off, they specify Class B or H to stretch insulation life. Where there is no appreciable price difference, preference is given to Class H.

But keep in mind that for everyday industrial applications the open-type motor with Class A insulation is serving well. Most promise for Class H insulation lies in motor applications in high ambients or where the unit is expected to ride through overloads. Typical applications are in the utility industry for large auxiliary-drive motors, steel mills and other users of large motors for heavy duty.

The above is based on a paper presented by J G Noest, Inside Engineer, Consolidated Edison Co of N. Y. The paper was given at the second Electrical Apparatus Conference sponsored by Owens-Corning Fiberglas Corp.

Batteries Unharmed by Fluorine-Treated Water

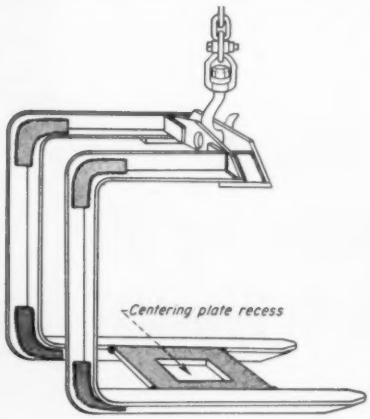
► RECENT EXPERIMENTS have shown that water treated with fluorine to prevent tooth decay has no harmful effects when used as the electrolyte in industrial batteries.

Tests were conducted at Gould-National Batteries laboratory at Depew, N. Y. to determine whether undistilled city water containing fluorine was harmful when used in industrial batteries.

Drinking water treated with fluorine normally contains two parts of fluorine per million parts of water. As battery water evaporates and is replaced with fluorine-treated water, fluorine accumulates in battery and may reach a concentration as high as 30 ppm under the most unfavorable circumstances. To simulate fluorine accumulation, the laboratory added 86 milligrams of sodium fluoride to one cell in each of three industrial batteries. It then put the batteries on a life test that took them through their life span in a shorter time than under actual operating conditions.

The cell containing fluorine, and the two adjacent untreated cells in each battery, were observed throughout the test until all batteries failed. The cell containing fluorine showed no unusual behavior and in no case did it fail before one of the other two cells. A safe conclusion is that fluorine-treated drinking water can be used in storage batteries without danger, provided of course, that the water was harmless before it was treated.

PRACTICAL IDEAS...*here's the trading post for your*



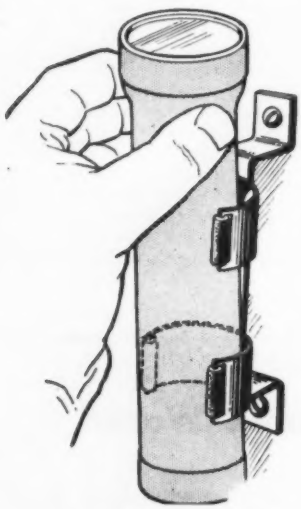
Yoke-Hook Speeds Up Battery Change

THIS STORAGE BATTERY lifting device, for quick battery changes in baggage trucks, is sent in by field engineer of Gould-National Batteries, Inc. Photo taken at New York's Grand Central Terminal. More than 100 battery-powered trucks are kept on job around clock to handle mail, baggage and newspapers. Only three minutes per truck is allowed for changing batteries.

This rig is handy where batteries must be removed horizontally, and when both end and top clearance in compartment is tight.

Pick-up element of lifting device is a large steel yoke-hook, welded from simple shapes shown. When removing a battery, slide bottom of yoke-hook into compartment under battery. Centering plate of 5x8x1 in. on battery's bottom fits into recess in plate welded between two arms of yoke-hook. This acts as a safety device to prevent battery from shifting position during handling. After positioning the rig, battery is lifted slightly with hoists, moved horizontally out of compartment and transported on monorail to charging racks.

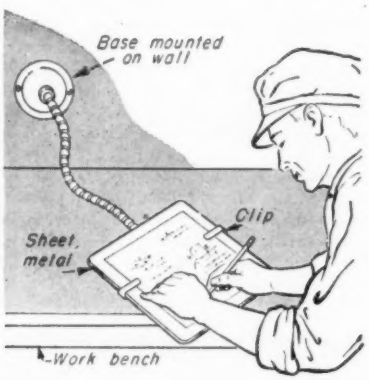
Because of the many trucks, battery changing is staggered. Not more than two trucks are in battery room at a time. Thus, battery in each truck is changed every other day, quickly and easily.



Wall-Mounted Flashlight

ONE, TWO OR MORE cell flashlights in a wall-mounted holder are as easy to find as any fire extinguisher. Buy two bicycle-type flashlight holders and mount two spring-steel clips on iron bracket.

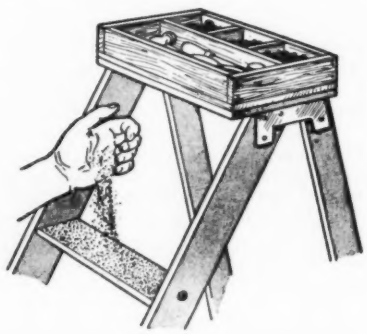
F LETTINO *Astoria, N. Y.*



Handy Workbench Support

HANDY SUPPORT, for drawings, magazines, instruction books, etc, often needed at the workbench, is made from a flexible-metal arm of discarded desk lamp, piece of sheet metal, and pair of metal spring-type paperclips, sketch. This support keeps reference materials off the bench, and can easily be positioned handy to lighting and working space. Such a device supplies extra convenience at practically no cost.

T TRAIL *Catonsville, Md.*



Utility Safety Steps

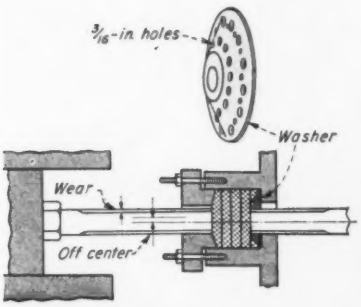
IT'S EASY to increase ladder safety with frictional steps. Just varnish or shellac steps. Soon as painted surfaces become "tacky," sprinkle fine sand on them. When dry, you have slipproof steps.

Box shown can be built on ladder's upper platform to hold such items as pencils, erasers, ruler, nails, hammer. Use 1x4-in. boards to build boxes sides —screwed and glued together. Make enough cubby holes for sufficient surface to stand on very top of ladder.

S V WORTH *New York, N. Y.*

operating and maintenance short cuts

STEVE ELONKA, *Associate Editor*



Special Washer Keeps Engine Running

A HIGH-SPEED ENGINE gave trouble by blowing packing out of stuffing box and into steam cylinder. Cause was worn piston rod, worn cylinder throat, and piston. This wear lets rod down, leaving opening above rod in throat. We had no time to rebore cylinder, install a new piston, rod, rings and throat-piece.

First, we tried a better and harder grade of packing. It didn't hold. A ring of metallic packing was then used in stuffing box. That didn't work either.

We made a large washer from 5/16-in.-thick bronze plate. Easy slide-fit in stuffing box prevented jam. We made piston rod hole in washer same as original size of rod. Outside washer corners were chamfered to slide. Piston-rod hole in washer was also tapered on inside where worn rod near piston entered.

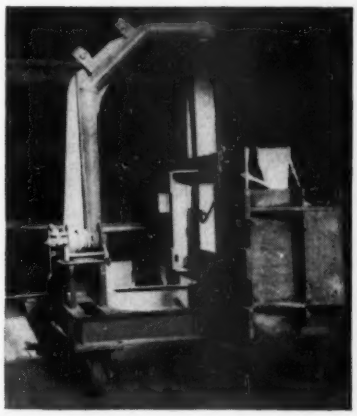
Crosshead was adjusted so rod would run parallel with cylinder's bottom and crosshead guides, as shown. Piston clearance was equalized, washer and packing put in after being coated with graphite and cylinder oil.

But engine sounded like a machine gun. We reasoned the high-pressure steam in crank end at beginning of stroke forced washer against soft packing. On exhausting, compressed packing expanded and slammed hard washer against bottom of stuffing box.

We tightened the gland nuts but that caused rod to heat. We solved problem by drilling 3/16-in. holes through washer as shown. Then we countersunk holes on packing side to get a shallow but larger diameter countersink. Holes helped counterbalance steam pressure on washer, and it's been working OK for several years.

When a cylinder is worn at bottom, piston has a greater bearing surface. Then it wears little, especially if well-lubricated and properly lined up.

J W BLAKE *New York, N. Y.*



Homemade Hand Crane For Special Jobs

BOOM IS DESIGNED for a safe lifting load of 5000 lb when using snatch block, or about 3800 lb on whip line. Two cross-beams under boom are reinforced with ¼-in. plate welded between both outside flanges. Inside corners of frame are also reinforced with plate.

Photo shows crane used to position a heavy bedplate for welding. This bedplate, one of six fabricated in welding shop without use of overhead crane, weighs over one ton. All six were handled very easily with hand crane, using a single line. For heavy work like placing a large motor in position, job can be done much easier and smoother by using snatch-block, hooked up as shown in shot of boom's top.

Over-all height of 8 ft was due to limited headroom in some places in our shop. We built crane especially for lifting motors off bedplates and carrying them out to open floor space for overhaul, in places where it's tough to string overhead rigging.

R SEPTOR *South Amboy, N. J.*

Selsyn Motor Is Good for Remote Control

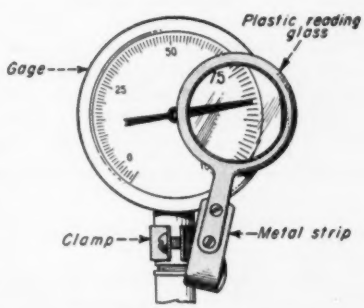
MACHINES in out-of-way place often require frequent adjustments. We have a vertical-core baking-oven about 50 feet high. There is an adjustable Reeves drive on the very top that varies oven conveyor speed.

In baking different-size cores, conveyor speed has to be altered. So we'd climb a vertical ladder and crawl over moving gears to adjust drive. This was tiresome and extremely hazardous.

To simplify, we installed a pair of 110-v war-surplus selsyn motors. One motor is coupled directly to the Reeves drive and the other is mounted in a convenient spot near oven tender. To adjust Reeves drive, the oven tender merely rotates selsyn motor. Other selsyn to Reeves drive keeps in exact step.

This arrangement, a hundred percent effective, costs only $5.95 for selsyn motors, plus actual wiring expenses.

H T BAILEY *Brillion, Wis.*



Gages Now Easy to Read

TO READ a pressure or vacuum gage more easily, especially those with fine divisions, attach an inexpensive, magnifying reading glass to the gage connection.

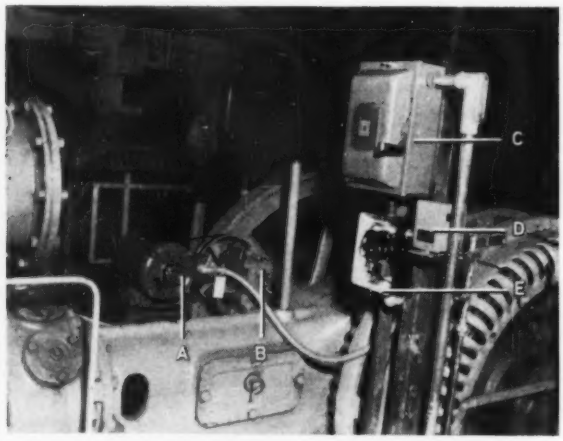
This not only pays off in reading the gage at a quick glance, but I've found that plant personnel actually look at gage because it is easy to read.

T TRAIL *Catonsville, Md.*

(*Continued on page* 126)

More PRACTICAL IDEAS

Begins on page 124



Excess Oil Given the Bum's Rush Now

SOME of our synchronous, motor-driven, 2-stage air compressors, operating continuously and equipped with pneumatic unloaders, delivered excess oil to the air system. Separators in discharge lines didn't often solve problem, even when blown down.

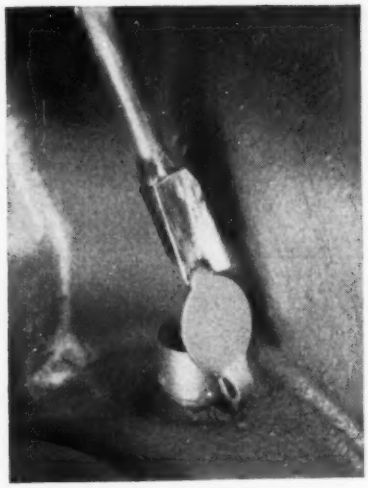
Cylinders were oiled by constant-speed force-feed lubricators. We reasoned that oil collected in lubricator during idling period. Then when machine loaded up again, oil was discharged into system in a slug. So we had to reduce cylinder lubrication during idling periods. Photo shows how we did this.

We changed belt drive of lubricator (B) from machine's shaft to a 2-speed motor (A). Motor is mounted on a bracket, bolted to compressor's frame. Pressure switch (D) is connected to small air line supplying the unloader. Switch contacts are wired to coil of a double-throw relay (E). Relay contacts are connected to high-speed and low-speed windings of small motor. (C) is a simple fused disconnecting switch for power supply to electrical devices.

When air-system pressure rises to unloading point, it actuates pressure switch. That operates to energize coil of relay, causing its contacts to move to position connecting the motor's power supply to its low-speed winding. This causes the lubricator to be driven at half speed during the idling period, delivering half the normal quantity of oil to cylinder. And that's enough lubrication while idling. As system pressure drops and machine loads up, contacts of pressure switch open. That de-energizes relay coil, and switches motor back to its high-speed winding. Thus lubricator delivers full capacity.

Several month's operation has proved that hookup is sound. Besides, excess oil to air system is now greatly reduced.

P N PITTENGER *Southport, N. C.*

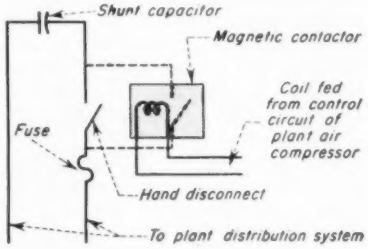


Oil-Cup Cap Lifter

WHEN MAKING ROUNDS with an oil can, spring-closed oil-cup caps prove very awkward, especially in a tight place. Often there's no room for fingers to hold cap open while oiling with the other hand. Lifting cap with can spout won't work as cap edge slips off rounded spout end.

Simple solution is to solder a strip of brass to oil-can spout. First, bend to a slight V-shape. Long spout can easily be inserted into confined spaces. V-piece holds oil-cup lid open, while oil is squirted into cup.

C T BOWER *London, England*

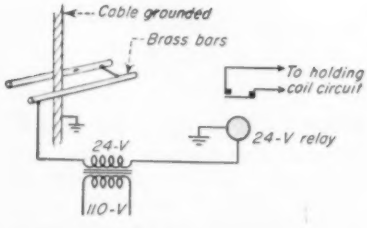


Magnetic Contactor Switches Capacitors

CORRECTING power factor by use of capacitors is pretty well-known in most plants.

In smaller plants, usual practice is to pull capacitor disconnects at end of day's run. This is a chore that's easily forgotten. It can be done automatically by connecting the capacitors through a magnetic switch to load side of starting compensators of air compressors, or other machines that make up a major part of plant's load, sketch.

H T BAILEY *Brillion, Wis.*



Positive-Acting Slack-Cable Switch

THERE ARE MANY TYPES of slack cable switches on the market. As a rule they work well. But in some applications these switches don't perform well as they are either too bulky or need too much cable pressure for proper operation.

After several unsuccessful attempts, we constructed the slack cable switch shown in sketch. Results have been excellent.

Cable switch contacts are two ½-in. brass bars, mounted at right angles to hoist cable. One bar on each side of cable has just enough clearance to avoid accidental contact in normal operation. If cable becomes slack, hoist cable touches one brass bar, energizing the 24-v relay. That, in turn, breaks circuit to holding coils of electrical system.

H T BAILEY *Brillion, Wis.*

New!

*Look what Powers has done to **Modernize** Control Valves*

Powers PACKLESS Valves Banish Packing Maintenance
Prevent leakage of water or steam or loss of vacuum

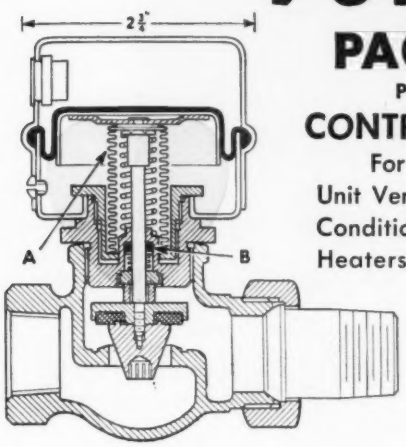
POWERS

PACKLESS

Pneumatic

CONTROL VALVES

For Convectors, Unit Ventilators, Unit Air Conditioners, Baseboard Heaters, Radiators, etc.



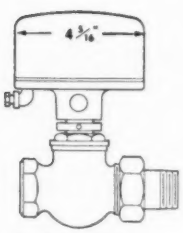
Various Types and Sizes for all requirements

Another POWERS Contribution to Better Heating and Air Conditioning Control

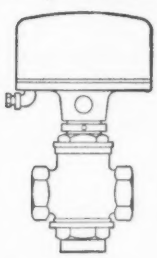
PACKLESS Valves with their many advantages are now standard with Powers temperature control systems. Their superior performance is due to duo-seal construction.

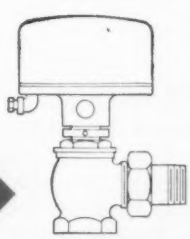
Bronze Packless Bellows (A) in sectional view above, is the primary seal which eliminates packing maintenance — packing friction — steam and water leakage or loss of vacuum. It is designed to withstand pressure up to 150 psi. Maximum valve stroke is only two-thirds of the normal bellows stroke. A spring loaded secondary seal (B) permits servicing of valve top without draining the water system or shutting down the steam heating system. Seal is made of highly elastic neoprene and is ready to act at any time. Small contact between seal and the highly polished stainless steel stem makes friction a negligible factor.

For utmost dependability and lowest cost maintenance specify control by Powers **PACKLESS** Valves.

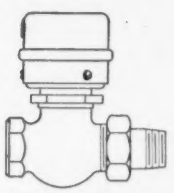


Straightway Union
3-Way Screwed Ends





Angle Union



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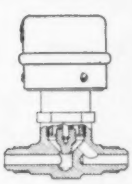
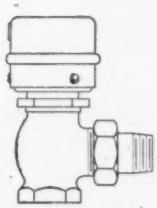


Flared Ends



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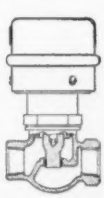
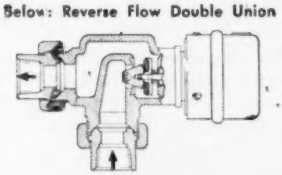


Below: Reverse Flow Double Union



(b2)

More PRACTICAL IDEAS

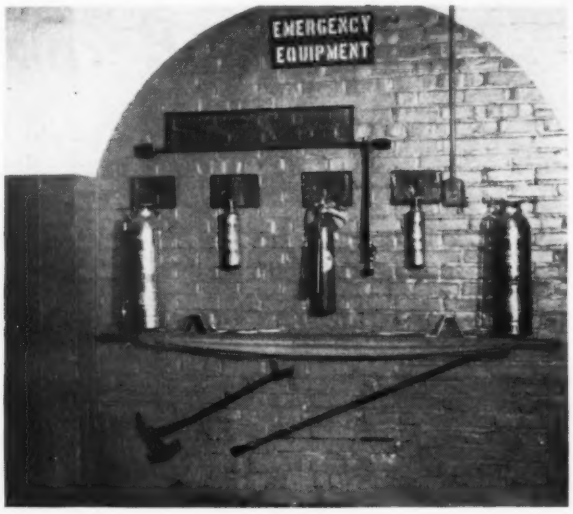
Begins on page 124

All Taped Up

I CAME ACROSS an electrician all decked out in friction tape, sketch. Tape around shirt sleeves and coverall legs kept them away from wiring.

Tape wound around plier handles kept him from getting a blood blister when he "miscued" with this implement. Tape around screwdriver handle not only helped insulate, but also protected hand grip and gave firmer hold.

D B CLAPP *Newark, N.J.*



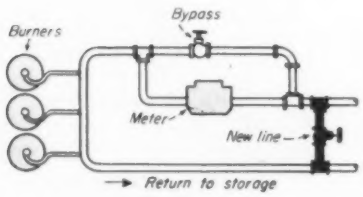
Emergency-Equipment Display Ready for Trouble

WE HAVE emergency-equipment centers at various places in our plants. This photo shows the one in main hallway of building No. 2.

Each center is along a well-traveled place so employes pass the center often and know exactly where to go in case of trouble. With fire extinguishers for various-type fires (all labeled besides stretcher, fire ax, etc, we are ready for action at all times.

Employes are so conscious of this equipment that they instinctively go to the right place every time that an emergency arises.

G HOGG *Philadelphia, Pa.*



Fuel-Oil Bypass Solves Problem

BURNING OIL in one of our 550,000-lb-per-hour high-pressure boilers gave us a problem. Things ran smoothly while carrying full load. Trouble came when we dropped load to what we called the critical load during the night. It's critical because one fuel pump isn't enough and two pumps were more than enough.

We can overcome this by opening recirculating valve, but then fuel oil won't register on meter correctly.

I checked the fuel-oil lines, noticed a free drain-connection on fuel-oil header before the meter. Also a free-drain connection on return line. I tied them together with ¾-in. piping and a valve as shown. This works well during critical load.

It now serves two purposes. Excess pressure is relieved during low loads, and return line going back to storage tank is kept warm in winter when it would freeze. Then hours would be spent getting it warm enough to thaw and to flow freely again.

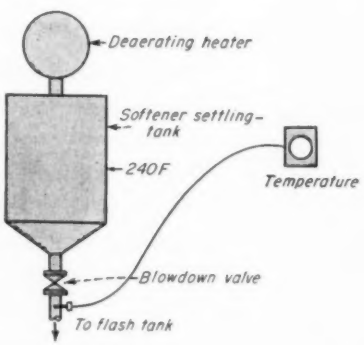
F A TURANO *Jersey City, N.J.*

Removing Tight Nut

NUTS FITTED in a recess are usually removed by a box spanner. If nut is very tight, you might have to apply heat to expand nut. First, place spanner over the nut. Then place a layer of boiler lagging over top of nut. Play a blowpipe flame down the center of the spanner.

Boiler lagging protects top of nut from direct heating and deflects heat to walls of spanner. This heats sides of nut, causing it to expand and loosen.

W E WARNER
Woodford Green, Eng.



How to Record Blowdown Frequency

MY SKETCH shows method for recording the frequency of blowdown used for a hot-process lime-soda ash softener. Adapt this temperature recorder to any type of blowdown and keep track of the operating engineer's performance.

M E EVANS *Chicago, Ill.*

new WIDER VISION

for easier remote boiler water level readings

■ Vastly improved visibility of remote boiler water level readings can now be enjoyed by boiler plant operators.

A new "wide vision" face on Yarway Remote Liquid Level Indicators allows reading from the side as well as front of the indicator. Boiler water levels and other liquid levels can be checked from most any position.

Indicating mechanism is operated by the boiler water level itself—assuring instant, accurate readings.

Yarway Indicators are of the manometric type with automatic temperature compensation, as approved for use under the recent A.S.M.E. Boiler Code Committee ruling in Case # 1155.

Over 10,000 are used throughout industry for boiler water and other liquid level indication . . . and for superheater pressure differential indication aboard ship.

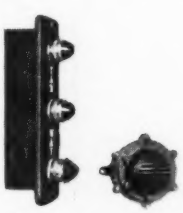
For full information write for Bulletin WG-1823.

YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES

A COMPLETE YARWAY SYSTEM

Besides Remote Liquid Level Indicators, Yarway also offers Liquid Level Recorders and Remote Signal Alarms . . . making a complete system for constant, accurate liquid level check.

■ Yarway Hi-Lo-Graph Recorder provides not only water level indication, but also a 24-hour recording of water levels. See Yarway Bulletin WG-1830.



■ Yarway Remote Hi-Lo-Alarm Signals—lights or horns—can be placed at any location in plant. See Yarway Bulletin WG-1823.

YARWAY

remote liquid level indicators

PLANT PROBLEMS... *put your know-how to work*

How Can We Detect Hot Machine Bearings?

I run an industrial power plant and am in charge of all equipment for both power generation and process work.

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I'm convinced this wouldn't happen if we knew the bearing temperature, or had an alarm that indicated temperature was rising. If we know how a bearing behaves, we get to it soon enough to prevent burning out.

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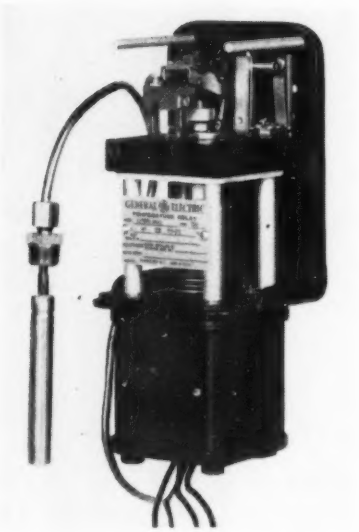

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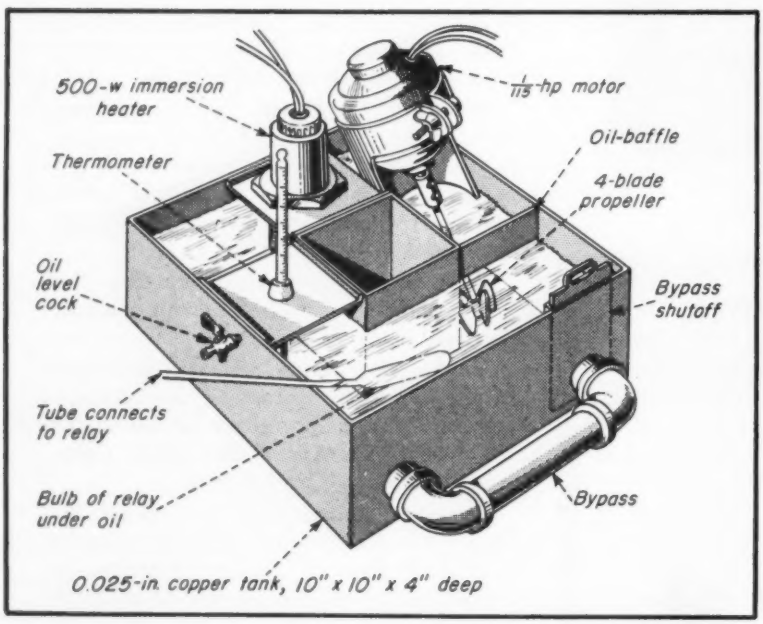

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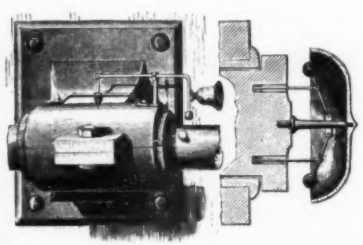
JIM SPARKS *Spokane, Wash.*



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Illustration, *right*, shows similar device for crankpin bearing of an engine. It rides in fusible plugs fitted snugly into end bores in the wristpin.

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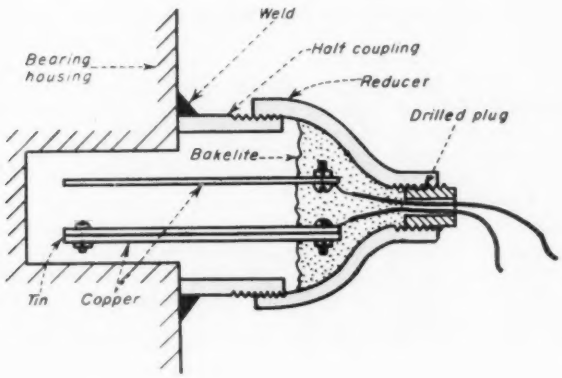
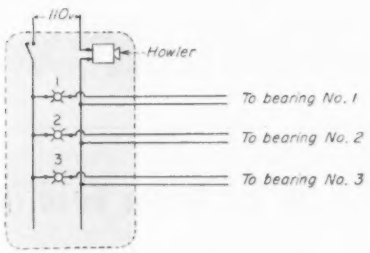
help the other guy cure his headaches

TYLER HICKS, *Associate Editor*

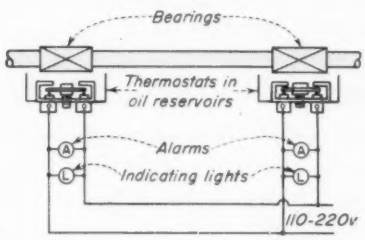


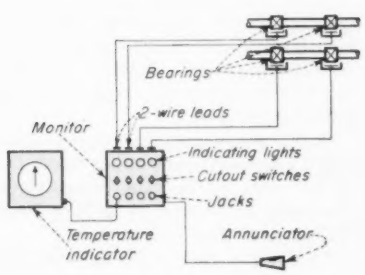


BIMETALLIC STRIP, inserted in a shallow ½-in.-diameter hole drilled in stationary part of each bearing, makes a simple temperature alarm. Sketches show setup.

Strips close contacts in a 110-v circuit. They can be purchased to close at just one temperature, or with an adjustment that permits you to select closing temperature. Run No. 12 RH wire from bearings to a central alarm panel. Hook up an industrial howler to warn personnel, and a small lamp to indicate which bearing is overheating.

JOHN COWAN *Solvay, N. Y.*





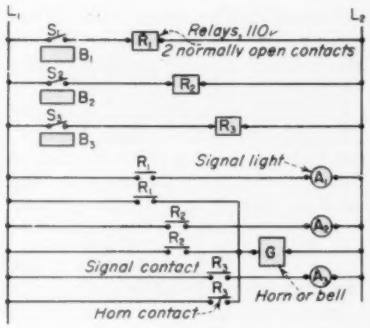
USE SNAP-ACTION bimetallic thermostats mounted in bearing lube-oil reservoir, as top sketch shows. High oil temperature causes thermostat to snap closed, energizing an alarm and warning light. Adjusting screw permits changing temperature at which thermostat closes. Mount alarm and warning light near bearing or on a central panel, whichever is most convenient.

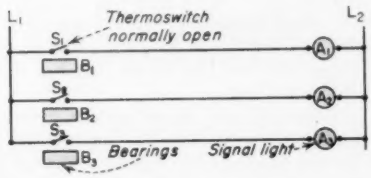
Though sketch shows only two bearings, any number may be served with this type of hookup. Installation cost is low.

Bottom sketch shows a typical hookup available from several manufacturers. Temperature probes may be located in reservoirs containing hot oil leaving bearings. Two wires lead from hot junction to monitor. This may have 25 or more double-wire leads that enter it.

Temperature indicator may be used for a single monitor. Or a portable one may be used when plant has more than one monitor. It indicates bearing temperature directly.

H B WAYNE *Brooklyn, N. Y.*





HOOK UP thermoswitches as shown in sketches. Clip to bearing housing or install in tapped holes in bearing shell. Bearing-temperature rise causes switch to close, lighting a warning bulb or sounding an alarm.

Lower sketch shows how relays can be used to sound an alarm, in addition to lighting a warning bulb. Each relay has two normally open contacts; one for the signal-light circuit, the other for the common alarm.

M E HEATH *Cincinnati, Ohio.*

SEVERAL WAYS to determine bearing temperature are: (1) by feel during periodic rounds, if bearings are accessible (2) with a thermometer taped or clamped to bearing housing (3) with thermometer inserted in hole drilled in bearing (4) with an electronic device. Though homemade devices have been used, a unit built specifically for this purpose is better.

Before buying special equipment, check overheated bearings to see they are suitable for the job and are not loaded beyond manufacturer's specifications.

L E POLIKOFF *Brooklyn, N. Y.*

(*Continued on page* 132)

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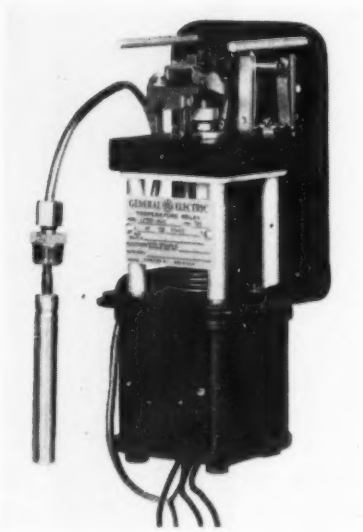

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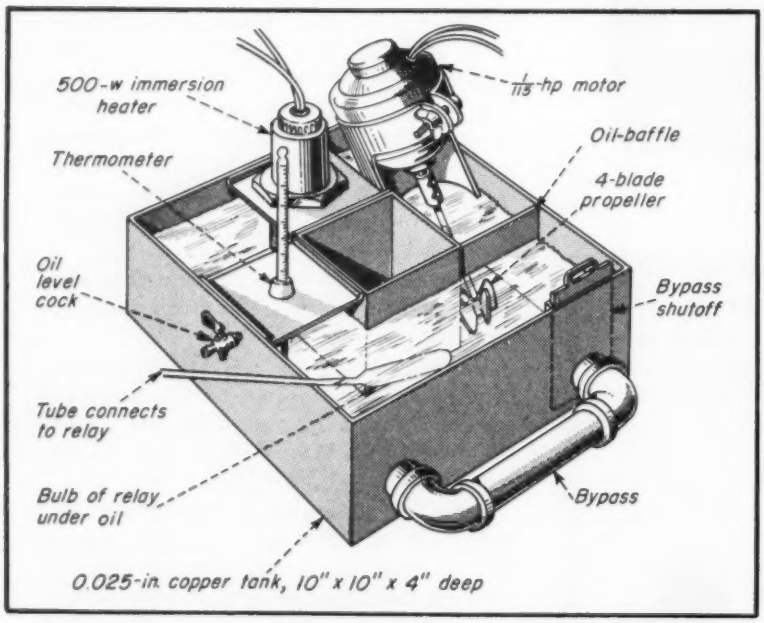

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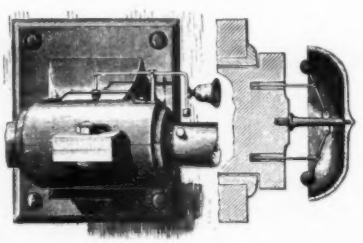

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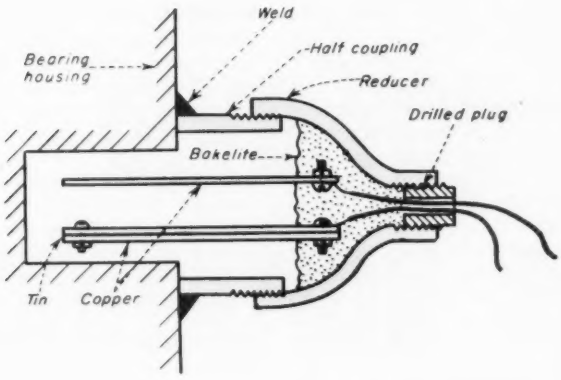

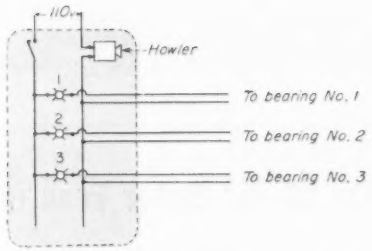

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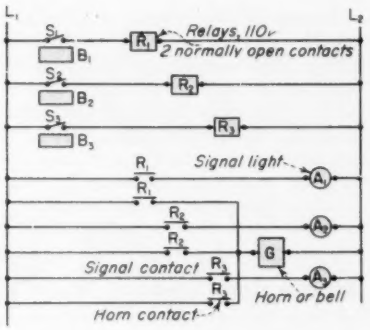

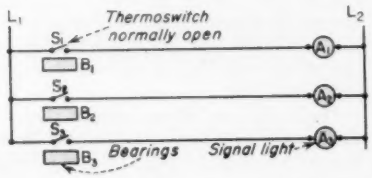

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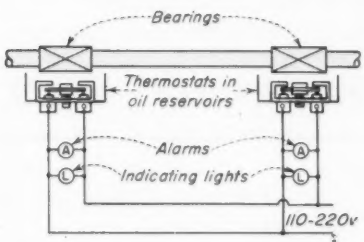
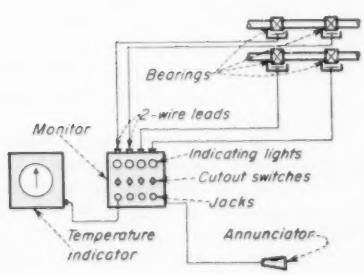
M E HEATH *Cincinnati, Ohio.*





USE SNAP-ACTION bimetallic thermostats mounted in bearing lube-oil reservoir, as top sketch shows. High oil temperature causes thermostat to snap closed, energizing an alarm and warning light. Adjusting screw permits changing temperature at which thermostat closes. Mount alarm and warning light near bearing or on a central panel, whichever is most convenient.

Though sketch shows only two bearings, any number may be served with this type of hookup. Installation cost is low.

Bottom sketch shows a typical hookup available from several manufacturers. Temperature probes may be located in reservoirs containing hot oil leaving bearings. Two wires lead from hot junction to monitor. This may have 25 or more double-wire leads that enter it.

Temperature indicator may be used for a single monitor. Or a portable one may be used when plant has more than one monitor. It indicates bearing temperature directly.

H B WAYNE *Brooklyn, N. Y.*

SEVERAL WAYS to determine bearing temperature are: (1) by feel during periodic rounds, if bearings are accessible (2) with a thermometer taped or clamped to bearing housing (3) with thermometer inserted in hole drilled in bearing (4) with an electronic device. Though homemade devices have been used, a unit built specifically for this purpose is better.

Before buying special equipment, check overheated bearings to see they are suitable for the job and are not loaded beyond manufacturer's specifications.

L E POLIKOFF *Brooklyn, N. Y.*

(*Continued on page* 132)

More PLANT PROBLEMS

Begins on page 130

REMEMBER, bearings overheat from several different causes. Lack of enough lubrication, wrong lubricant and overloads are a few common causes. Heavy roll bearings may be overheated by radiation from material being processed.

Old-timers used a simple tallow cup to warn them that bearing temperature was too high. They added sulfur or some other substance to the grease in the cup. Your nostrils told you when grease melted.

Remember that alarms only indicate trouble, they do not cure it. Consider fitting water-cooling coils to bearings that now overheat.

There are certain oils and compounds that permit you to continue running a hot bearing, but it's better to keep the bearing cool from the start by right loading, lubrication and maintenance.

ALBERT MOULTON *Pittsfield, Mass.*

AN OLD CHIEF I had some years ago advised, "Spit on it, son. If it spits back, it's too hot." What he meant was that you could always check a bearing's condition by feel. If its feel left you in doubt, all you had to do was use the old water test.

Don't rig an alarm system before finding the safe operating temperatures for the bearings. Check on the critical temperature, too. Manufacturer will gladly supply this information.

L M MARTINEZ *Rego Park, N. Y.*

HOT-WATER AQUASTAT did the trick in our plant. Remove oil-well drain plug, and install bulb so it projects into the oil. We use reverse-acting aquastat; it makes instead of breaks. Wires from it lead to an annunciator drop.

W J STEINERT
Fresh Meadows, N. Y.

THERMOMETERS, dial or industrial glass type, do good job and are more accurate than feeling bearing. We make it a point to read every bearing-mounted thermometer at regular intervals.

Where bearing temperature is more critical we have dial thermometers, either indicating or recording, to sound an alarm when temperautre is high.

Third method we use in our plant has thermocouples and a multipoint recorder. Thermocouples are installed in a bearing well or in oil reservoir with wires leading to recorder. This setup has the advantage of allowing one operator to check bearing temperatures all over the plant.

E W MCKNIGHT
Chapel Hill, N. C.

PAINT BEARING CAPS with a heat-indicating substance. It will change color when an unsafe temperature is reached. There are several suitable paints on the market for this service.

W F MYLES *Montreal, Can.*

ALARM BOMB, which explodes with a sharp report and discharges white smoke having a distinctive odor, is now used on some types of bearings. Temperature at which bomb goes off is fixed by its materials.

CW's prime consideration should be the cause of bearing overheating. Once he knows this he has a much better chance of curing the trouble.

P KNIGHT *Toronto, Can.*

ON MOST MACHINES, bearings overheat gradually. So if you check them periodically, you'll have a good chance to stop temperature rise. Alarms are good, but they should be checked by a regular inspection of the bearings.

A HUNNEWINKEL *Woodstock, Ill.*

RECORDER actuated by thermocouple attached to bearing allows you to observe temperature rise. Regular observation of recorder provides ample warning of a temperature rise.

MELVIN EVANS *Chicago, Ill.*

USE THERMOMETER and thermocouple. Arrange thermocouple set to off an alarm or light a lamp when temperature exceeds a safe level. Thermometer shows bearing temperature at all times.

RICHARD CONK *Newark, N. J.*

SET UP A LOG for bearing temperatures. Have watch engineer check temperature readings at least every half hour, oftener if necessary. Once *WC* knows bearing temperature is rising, he can do something about it.

C G HOWARTER *Canton, Ill.*

Is Rain Water OK for Boiler Feed in This Plant?

We propose to collect rain water from our buildings' roofs, and feed it to our boilers. But before going ahead with the work, I'd like to get the opinion of *Power* readers.

Our boilers are watertube units. Three are bent-tube types, three straight-tube types. Roofs of all buildings are slate and metal.

Rain water from the roofs is conducted through metal down-spouts, and then through sewer pipe into underground concrete reservoirs. From this storage area we intend to draw water for our boilers.

All metal roof fittings and downspouts are copper. Will this affect rain water? What's best way of treating and pumping this water to boilers?—*WK, May Power*

Here Are the Answers

BE CERTAIN rain-water supply is sufficient for feedwater needs at all times. In many parts of the country it would be risky to depend only on rain water for supply because there are prolonged dry periods. If rain-water supply is insufficient, consider an alternate source and type of treatment it would need.

Contrary to popular belief, rain water is not free of impurities. Depending on locality, rain-storm duration and storage-basin construction, rain water may contain more dissolved salts than, for example, New York City water. In regions where much coal is burned, acid gases in atmosphere may show up in the rain water.

If *WK's* boilers are low-pressure units that are conservatively rated, it may be possible to use rain water without external treatment, except for deaeration to remove oxygen. Remove dissolved hardness with internal treatment, using a boiler compound.

But if his boilers are high-pressure units, external treatment is needed, just as for units of this type using typical low-solids city water, as in New York, Boston and other cities.

Unless the rain water is unusually

NEW SOLNUS OILS GIVE YOU MORE LUBRICATION PER DOLLAR

New Multimillion-Dollar Plant Producing Better General Lubricants at Moderate Prices

They can be used for lubrication of plain bearings, antifriction bearings, linkages, slides, cams and gears; in gear boxes, hydraulic systems, circulating systems, industrial diesel engines, compressors.

They can be used for longer periods because they resist oxidation, prevent rusting and corrosion.

They can be applied by every method used in the general lubrication of industrial machinery.

They have low carbon content In compressors, for instance, any carbon that does form is soft and fluffy, is easily blown off, does not build up.

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More PLANT PROBLEMS

Begins on page 130

BOILER WATER CONTROL REPORT

COMPANY _____ FROM _____ 19__ TO _____ 19__

ADDRESS _____ SIGNED _____

DATE (fill in)			
Source of Sample		Boiler No.	Boiler No.
Hardness			
P Alkalinity			
M Alkalinity			
Chloride			
Phosphate			
Sulfite			
Manual blowdown			
Continuous blowdown			
Source of Sample		Boiler No.	Boiler No.
Hardness			
P Alkalinity			
M Alkalinity			
Chloride			
Phosphate			
Sulfite			
Manual blowdown			
Continuous blowdown			
Source of Sample		Softener Effluent	Boiler Feed Water
Hardness			
P Alkalinity			
M Alkalinity			
Source of Sample		Condensate	
Hardness			
P Alkalinity			
M Alkalinity			
Softener Operation	lbs.		
	lbs.		
	lbs.		
Internal Treatment	lbs.		
	lbs.		
	lbs.		
	lbs.		
Fuel burned			
Quantity Feed Water			
Feed Water Temp. °F			

NOTE: Place on reverse side any pertinent remarks relative to boiler inspections, unusual operating condition, etc.

PLANT COPY

acid, I do not believe pickup of copper from gutters and downspouts would be objectionable. However, if copper is picked up, it can be removed by ion-exchange treatment. Hardness and other cations can be removed at the same time.

Dirst and dust may be present in rain water. If storage basin is large, growth of organisms will be considerable. Treatment for clarification and reduction of organic matter may be needed, particularly if you are using ion-exchange equipment on the job.

DURANDO MILLER
The Permutit Co, New York, N. Y.

DON'T USE rain water from building roofs because the amount that is collectable represents only a small percentage of a plant's yearly raw-water needs. I think it poor economy for *WK* to treat rain water for boiler use.

Rain water may have low pH, much dissolved oxygen and carbon dioxide, and can be difficult to deaerate. Without treatment it corrodes ferrous metals.

Dust and dirt from building roofs form solids that must be removed. Then there is almost always some rotted vegetable matter lodged in roof eaves—usually twigs and leaves that further contaminate the water.

If *WK* already has water-treatment equipment to handle water from another source he may find that a sudden switch to rain water would upset his treatment cycle. If he has no treating equipment now, his best bet is to consult a reliable manufacturer who will analyze his raw water completely before making any recommendations. It is also advisable to have regular checks made on the water once the equipment is installed. Chart shows a typical report sheet issued for boiler-water control.

ART BELTON *Montreal, Can.*

RAIN WATER is theoretically pure and excellent for boiler use. But in *WK's* case it will be contaminated by dust

(*Continued on page* 208)

YOUR NEW PROBLEMS

What Causes Tail-Pipe Water Hammer?

Several months ago we installed a steam-jet refrigeration system with a barometric condenser. It's fitted with usual secondary ejector and inter-condenser, and a third-stage dry ejector.

After system start-up, there was a distinct and loud water hammer in tail pipe near the 90-deg base ell. It wasn't heard when condenser vacuum was less than 27.8 in. Hg, nor when steam ejectors were turned off and condensing water allowed to flow through tail pipe alone. Except for this water hammer, system operation was fine.

We need 29.75 in. Hg to obtain a chilled-water outlet temperature of 40 F. This could not be obtained without accepting the water hammer, changing steam jet to get higher compression ratio, moving entire installation so tail pipe is vertical, or changing the 90-deg ells to form a very slight angled flow at hotwell bottom. All solutions seem too expensive, except the one of accepting the water hammer.

Test vent was put in to draw air out of tail pipe, but it didn't work. What else can we try? Increasing tail-pipe vent 2 to 6 in. did no good. Any suggestions from readers?—*EM*

How Can We Stop Corrosion in Well?

Cooling systems in our plant are served by several deepwells. Each well has a 4-in. pipe that discharges water to our heat exchangers and condensers.

Pressure at well is 90 psig with a fairly steady flow rate. Water temperature is 58 F.

What sort of hookup can we use to control corrosion in both the lines from the wells, and in the heat exchangers and condensers? What point is best for injection of chemicals? Is periodic acid cleaning of the heat-exchange units better than continuous chemical?—*ST*

Will you help readers who sent us problems? Extra pay for photos or sketches.

Modern power plant practice demands a water conditioning program that produces only the ultimate in trouble-free and efficient boiler operation.

External softening and the use of conventional inorganic treatments are recognized requisites. However, the supplementary use of organic agents may well assure the difference between long, uninterrupted operation and frequent boiler outages due to scale and sludge formations.

Take the case, for example, of a large electrical manufacturer, who called in Betz 14 years ago to treat its new power plant. This plant operates at 900 pounds pressure with 50% make-up polluted river water. Betz recommended the use of organic agents to supplement the external softening and inorganic treatment.

Here are the results from the record: In the entire 14 years operation of these boilers, they have never been turbined or acid cleaned and no difficulties from feedwater conditions have occurred! What's more, excellent steam purity is produced and turbine blading is completely clean.

This plant could easily be your plant—operating efficiently, free from frequent boiler outages through the effective use of Betz *Specialized* Water Conditioning Service. Why not call on Betz today for an interesting discussion of your water problems? There's no obligation, of course. W. H. & L. D. BETZ, Gillingham & Worth Streets, Philadelphia 24, Pa. In Canada: Betz Laboratories Limited, Montreal 1.

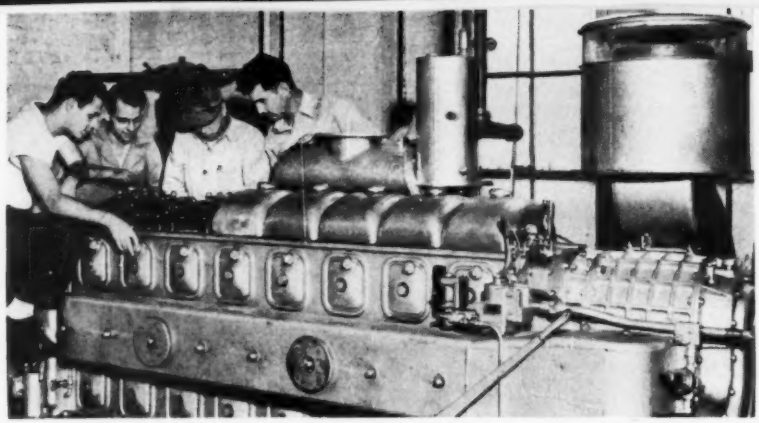
Send today for Betz Technical Paper No. 98, "Boiler Scale—Its Formation and Prevention." It's free.

BETZ

CONSULTANTS ON ALL WATER PROBLEMS

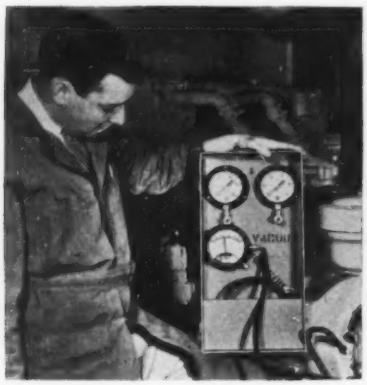
HOW TO

Check For Eight Diesel Faults

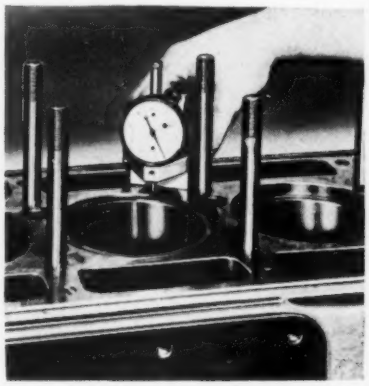


Courtesy, Kent-Moore Organization, Inc

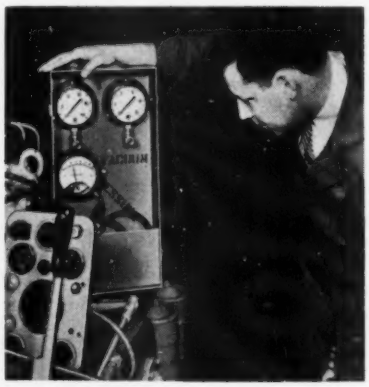
FAULTS are easy to diagnose if you have the right instruments for doing the job



1 **RESTRICTION** to blower intake is found with vacuum side of this gage

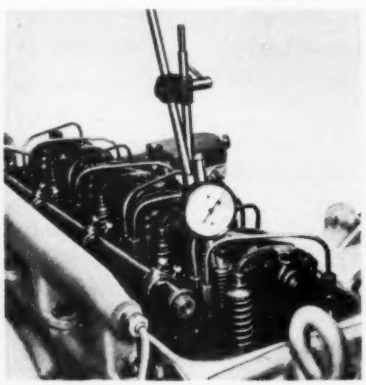


2 **DEPTH** of cylinder liner is found here by using dial indicator on gage block



3 **BACKPRESSURE** on engine is read at a glance from gage hooked to exhaust

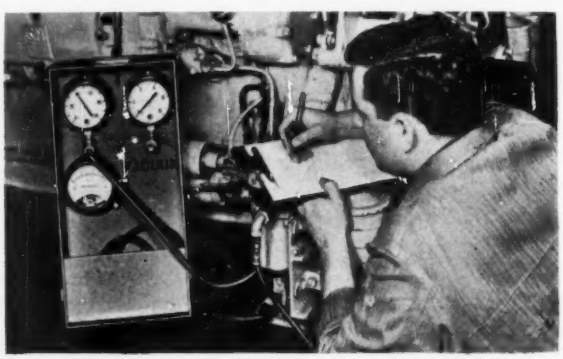
4 **RPM** of engine is read from tachometer attached by flexible extension



5 **TIMING** of engine is checked with indicator held on cylinder head as here

6 **CRANKCASE** pressure shows up on this gage hooked directly to crankcase

7 **AIR-BOX** pressure is read from low-pressure gage that registers from 0 to 15 psi. Recheck if engine is adjusted

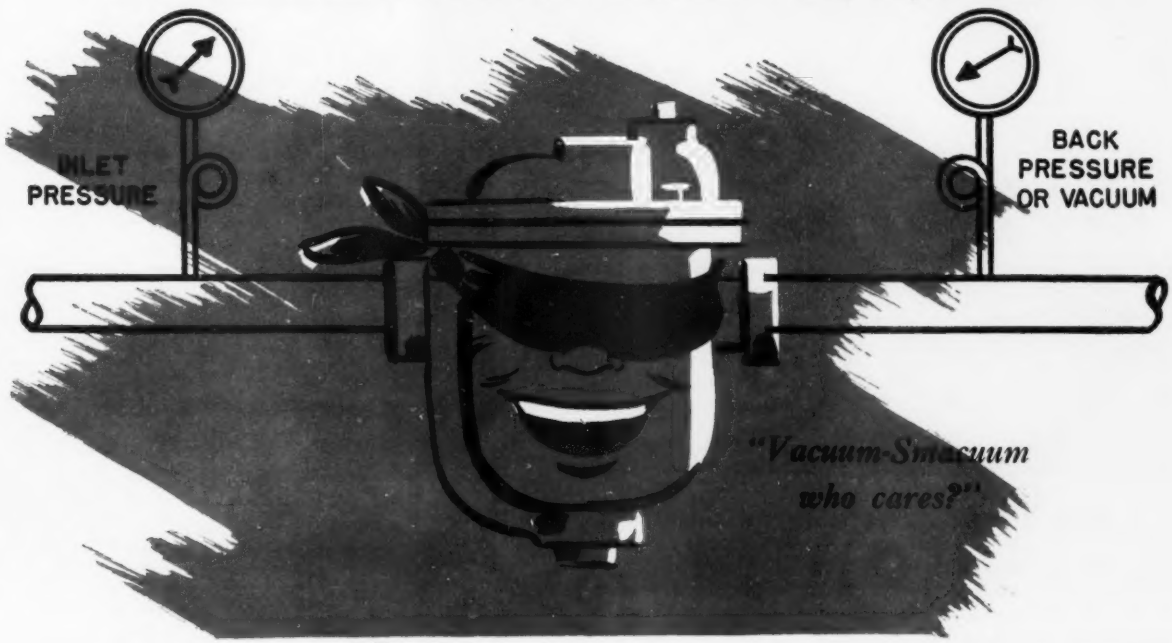


8 **OIL PRESSURE** must be known to avoid serious breakdown. Gage is hooked to parts of engine needed for information

VACUUM ISN'T VACUUM

TO A STEAM TRAP

. . . It's Just Pressure Below Atmospheric



ONLY 2½¢ per year per trap parts costs on traps averaging 11 years of service at Globe Steel Tubes Company, Milwaukee, Wisconsin.

***PRACTICALLY ZERO maintenance*, complete satisfaction with traps after 12 years service on 10 lbs. pressure, 5" vacuum—Liquid Veneer Corp., Buffalo, N.Y.**

***Send for 4-page Bulletin No. 223, "Vacuum Isn't Vacuum"—a complete discussion of vacuum, effect on trap selection, causes of vacuum loss, effect of flash steam, etc. Free on request. Just fill in and mail the coupon.**

BUYERS are sometimes told that steam traps for vacuum return service must be "different"—requiring, we suppose, some mysterious ability to recognize vacuum and act accordingly.

The truth is that vacuum isn't vacuum to any steam trap. It is just pressure below atmospheric pressure. All vacuum does is increase the pressure differential across the trap orifice. An Armstrong trap doesn't care whether it discharges to vacuum, back pressure or atmosphere. It works just the same in all cases.

Because Armstrong traps don't have to wait for condensate to cool, drainage is fast and equipment temperatures and BTU output are maximum.

Armstrong traps won't cause you to lose vacuum. Any flash steam from their discharge is quickly condensed. *It is the leaky traps that make it hard to hold vacuum!*

The mechanisms in Armstrong traps for low pressure vacuum return service are identical in design, workmanship and materials to those used in traps for 900°F, 950 lbs. pressure. They can't help but operate a long, long time without leaking. This makes it nice for the maintenance man, too.

Fast heat-up, high temperatures, low maintenance, long life—all wrapped up in one package. Ask your Armstrong Representative to go over your vacuum heating system with you.

ARMSTRONG MACHINE WORKS
812 Maple St., Three Rivers, Michigan

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Please send Bulletin 223, "Vacuum Isn't Vacuum"

Company _____

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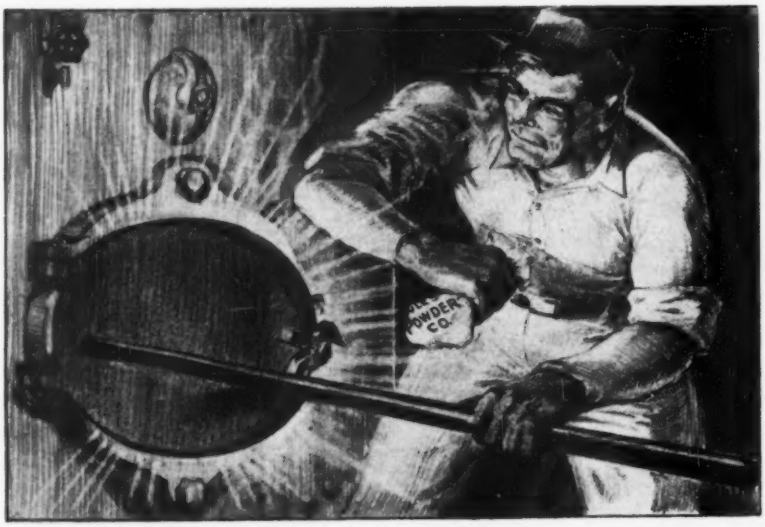
City _____ Zone ____ State _____

ARGUMENTS

Here's the place to unload your gripes to editors, manufacturers and fellow engineers



Old Timer's System for Cleaning Tubes

SURFACEBLOW'S STORY about shooting the plugged smokestack (POWER, Mar, p 142) reminds me of an old railroad-construction man, who told of clearing upright boiler tubes with some black powder wrapped in paper. He threw the powder into the firebox and held the door shut with a crowbar.

When she let go, the blast would do a fair job of loosening soot, if not the ash pan and stack hood as well.

K R McCORMICK
Edmonton, Alberta

EDITOR'S NOTE: *This reminds us of burning the house to get roast pig for dinner. We don't recommend it.*

More About Critical Pressure of Steam

In April *Arguments*, A J Kuchinsky wants four reasons why steam can't form above 3226 psi. There are no such reasons; steam has been formed well above the critical pressure of 3206 psi, and it can be done again by anybody who installs a critical-pressure boiler.

In principle, the critical-pressure boiler introduced by Benson can be represented by a single tube with a pump at one end and a throttle valve at the other, heated along its entire length.

Think of three men running the boiler sketched above. Feed-pump operator must keep pressure P_2 ahead of the throttle valve well above critical. Pump discharge pressure, P_1, will be considerably higher, perhaps 3500 psi, because fluid moves through the boiler at high velocity, and tube diameter is small.

The fire-control operator maintains desired temperature, t, ahead of throttle valve, perhaps 1000 F. Throttle-valve operator adjusts to hold pressure P_3, at the desired value, perhaps 1500 psi.

This is a once-through boiler; liquid water enters from the pump and steam emerges at the same flow rate through the throttle valve. There is no drum and no water level. As fluid passes along the tube its temperature rises and its density falls. Near the critical temperature, 705 F, density decreases rapidly as fluid changes from what we surely call liquid to what we can only call steam.

We can't say at what point the change occurs; the fluid field in this high-pressure region is strictly continuous. At no point is the stream part liquid and part vapor; entire stream changes gradually from one to the other.

Here's the reason for the throttle valve: If we supplied 3300-psi 1000-F steam to a turbine, expansion would take steam too far into the "wet" region and we'd have excessive moisture in low-pressure stages. Throttling and re-superheating is one remedy. Operating on the reheat cycle is another.

C H BERRY *Cambridge, Mass.*

Questions Sears' Value For Strain on Eyebolts

We were much interested in the May article by John Sears on hitching equipment. The statements concerning eyebolts were especially interesting inasmuch as we have done considerable eyebolt testing to determine their safe lifting capacities at angle loads.

We find our straight or vertical pull for a 1-in. eyebolt agrees with Sears' value of approximately 2½ tons (we get 5520 lb). But we get better than twice his value for the 90-degree pull—he indicated 200 lb, we get 590.

J W LA LONDE *Milwaukee, Wis.*

Sears Figures Eyebolt Strain This Way

In reply to La Londe's query, above, on safe 90-deg load on a 1-in. eyebolt, I must admit I don't recall our making a series of tests for our value of 200 lb. But W E Rossnagel, *Handbook of Rigging*, McGraw-Hill, 1950, lists 5100 lb for straight pull and 210 lb for 90-degree pull. And Marks' *Mechanical Engineer's Handbook* lists 5185 lb for straight pull.

Granted that 10 tests are worth 100 calculations, I cannot see how La Londe's values of 5520 for straight and 590 for 90-degree loads jibe. Let's take a shoulder eyebolt with point of pull 2⅛ in. from point of maximum stress. This gives them all the benefit, for the same distance is 2½ in. in a non-shouldered eyebolt.

If yield strength is 40,000 psi and root diameter 0.846 in., the formulas $P = as$, for straight pull, and $M = S(I/c)$, for 90-degree pull, show ultimate loads of 22,400 lb for straight and 1130 lb for 90-degree pull. With La Londe's load values, factor of safety on straight pull is 4.04; on 90-degree pull it's 1.92. With our values, factors of safety are 4.5 and 5.62, respectively.

Possibly the answer to his high 90-degree load value lies in the method of forging. In a shoulder eyebolt, as the metal is forced into the shoulder die and stressed above its proportional limit, grain refinement and strain hardening result. Crystals are elongated and tensile strength of the metal increases in direction of crystal flow. Of course, this still does not explain the wide discrepancy between his two factors of safety since this increased strength affects the load in both a straight and a 90-degree pull.

J R SEARS *Bellport, L.I.*

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for every purpose
EFFECTIVE SEALING

Ankorite "O" rings provide effective sealing through a range of pressures, temperatures and movements. When properly applied they exert low running friction on moving parts.

Ankorite "O" rings are accurately molded to close tolerances from compounds of natural rubber, Ankoprene, Buna N, Thiokol, Silicone, etc.

They offer many advantages:

1. Production cost is reduced by elimination of complicated assemblies.
2. Special assembly tools are not necessary.
3. Economical to use since only one "O" ring is required on piston or rod.
4. Long life, fluid-tight packing is assured with correct design and machining of grooves and mating parts.

"O" ring gaskets used as static seals have been known to withstand pressures as high as 15,000 p.s.i. In most other applications "O" rings are suitable to pressures up to 2,000 p.s.i. where radial clearances do not exceed .003".

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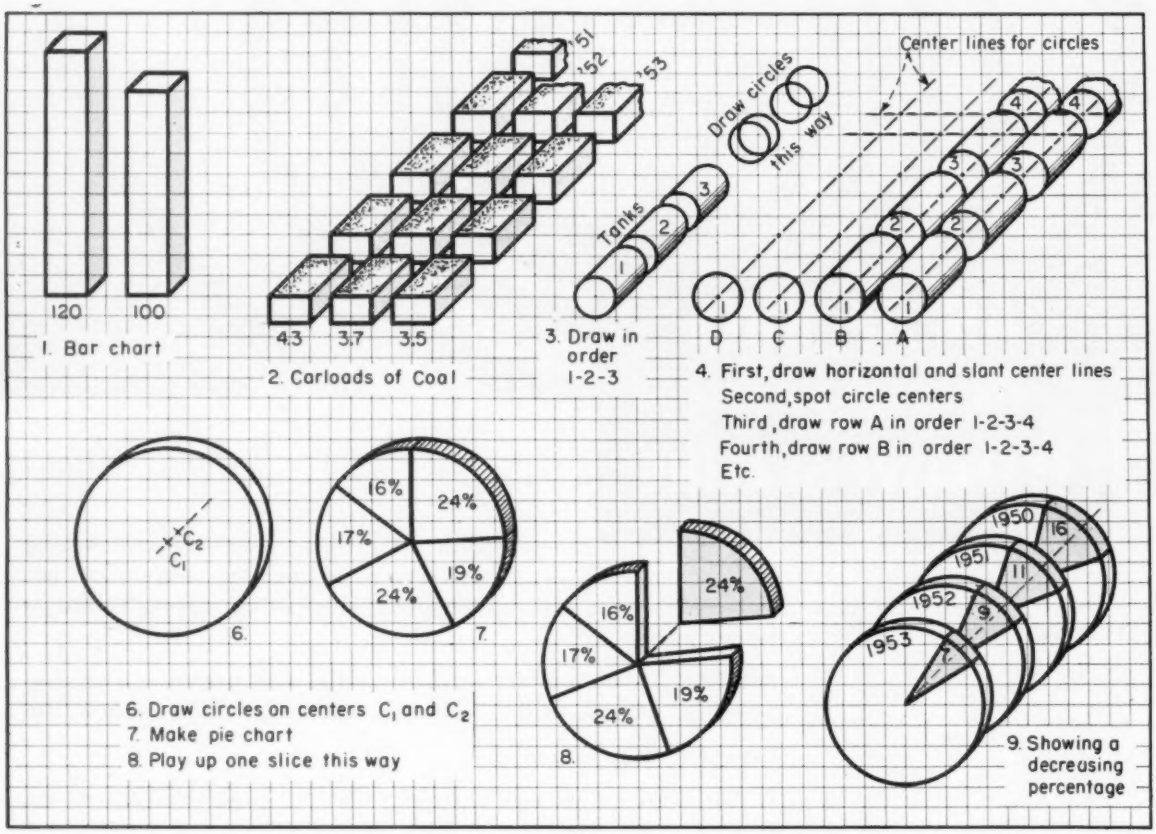
HEADWORK

PHIL SWAIN BRINGS ENGINEERING THEORY DOWN TO EARTH



Easy Sketching System—12

► HERE ARE some more ways to put life into dull engineering reports.

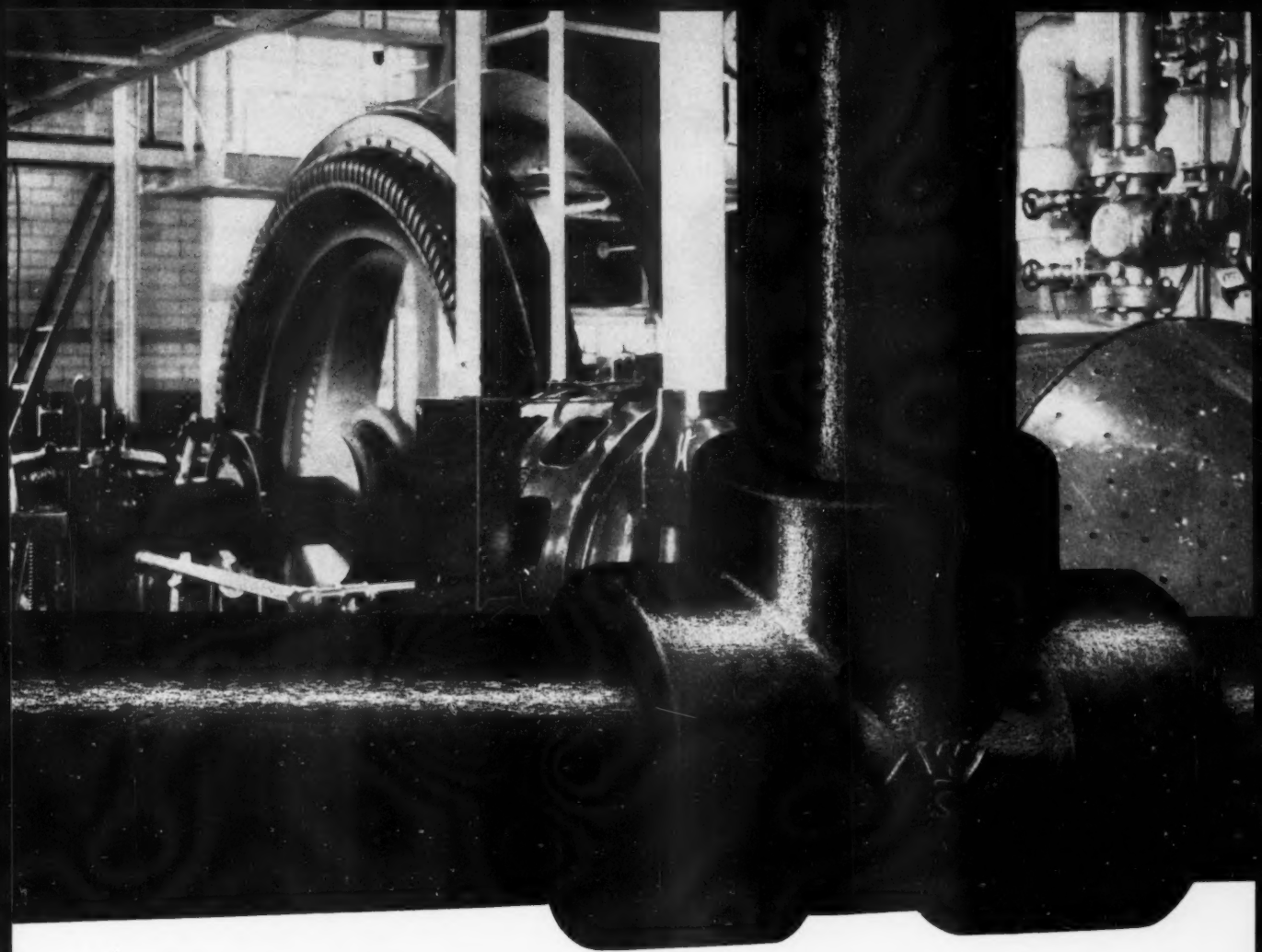
Fig. 2 shows how to drive home the fact that you have been saving coal. Chart shows you burned 4.3 carloads (per month, week or day) in 1951, cut this to 3.7 cars in 1952, and 3.5 cars in 1953. Note that the front cars partly hide those behind, also right-side cars partly hide those at the left. So, to save erasing, draw the right-hand front car first. Then work back in that row. Next, draw the 1952 row, again starting with the front car and then working back.

The same idea holds for the oil tanks in Fig. 3 and 4. Drawing tanks in the indicated order will save a lot of erasing of hidden parts. The tanks are drawn so the ends, which face you, are simple circles. Depending on the size of your plant, each tank may represent an actual tank car of fuel oil, or any other convenient unit—say 1000 or 10,000 gal.

You've often seen "pie" charts showing how 100% is divided up among several uses. To draw such a pie chart in three dimensions: first (Fig. 6), spot centers C_1 and C_2 for near and far faces of disk. Next (Fig. 7), complete the near face as for a conventional pie chart. Then draw the indicated edge lines.

Fig. 8 shows how to dramatize one particular segment when you want to call attention to it. For the best effect, arrange the chart so this segment is in upper right-hand corner, as shown.

Fig. 9 drives home your accomplishment in cutting down a certain cost over a 4-year period. More next month.



THEY'RE LOOKING DOWN YOUR PIPELINE...

Those twin scourges of industry—Lost Production and High Maintenance—are constantly drawing a bead on economical operation . . . looking down this nation's arteries for the lines of least resistance to heat, pressure and corrosion.

There *is* one way to spoil their aim: make sure that *your* pipe and tubing sections are joined with fittings of a kind that match them in chemical and physical properties, in strength and weight.

W-S Double-Diamond FORGED STEEL Fittings in both screw-end and socket-weld types give you all these qualities . . . provide life-of-the-line joints for any kind of make-up.

Literature is available . . . write for it.

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WATSON-STILLMAN FITTINGS DIVISION

H. K. PORTER COMPANY, INC.

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"Lizzy entered the plant quietly, and pulled the switch," said Marmaduke

'Lights Out'

► IT'S ALWAYS ENCOURAGING to find so many letters for, or about, Marmaduke Surfaceblow in our mail.

Says one admirer, "Our shift engineers didn't read anything before, but they now read and talk about Marmy's latest yarn. Some of them have even got the habit of going through POWER pretty thoroughly since Marmy joined up."

"Marmy has forgotten more about plant operation and maintenance than I'll ever learn, and I sure learn a lot from his stories," writes another.

"I may be too busy to read most magazines that come into our plant, but I always find time to see what Marmaduke has to say, soon as POWER arrives," says a third.

With these comments buzzing around in my bonnet, I went up to the old consulting engineer's office above O'Houlihan's Machine Shop & Engine Works. But the door was locked, so I headed for Bedlam's Bent-Propeller Bar down the street.

There was Marmaduke Surfaceblow, Esquire, consulting engineer extraordinary, all 6 feet 4 inches of him, at his usual end of the crowded bar. He must have made a killing on a consulting deal, or, more likely, had put a few dollars on the right horse. For atop his dome, at a rakish angle, was a brand new gray bowler. As for his suit, it looked like the latest hand-tailored creation, imported from Bond Street, London. And he sported a new checkered vest, loud enough to rile a bull. And those pearl gray spats—Wow! Even his heavy silver watch chain dangling from his vest seemed to sparkle more than usual.

There was no question about it. Here was a man of the world—an engineer whose dignified presence, at any gathering, commanded instant respect.

As usual he was aloof, gazing intently at the bottle of Sandpaper Gin before him—paying no attention to us ordinary mortals. Many of us, no doubt, had gathered only to hear his words of wisdom when and if he were in the mood to sound off.

What was he thinking about as he gazed at his bottle? Who knows? Perhaps a new slant on Einstein's theory of relativity—or a practical way to harness the sun's vast energy.

Then without warning, he suddenly got a strangle hold on his bottle, worked up at least 29.5 inches of vacuum on his cargo pump, and ballasted the bottle's entire contents into his double bottoms.

Venting off the highly volatile fumes, he snorted in his foghorn voice: "BILGEWATER ON SHIRKING RESPONSIBILITY! I'll tell you about a woman who kept one good engineer from going to the dogs."

The noisy place became silent. Our hero turned majestically toward his audience. With thumbs hooked into the armpits of his flashy vest, he blasted away in his foghorn voice.

"Back in 1932, I was in Troedyhim, Glamorganshire, England, paying a visit to my old limey shipmate, Jock Renshaw. Jock was chief engineer, shift engineer, maintenance man and janitor at the small municipal powerhouse.

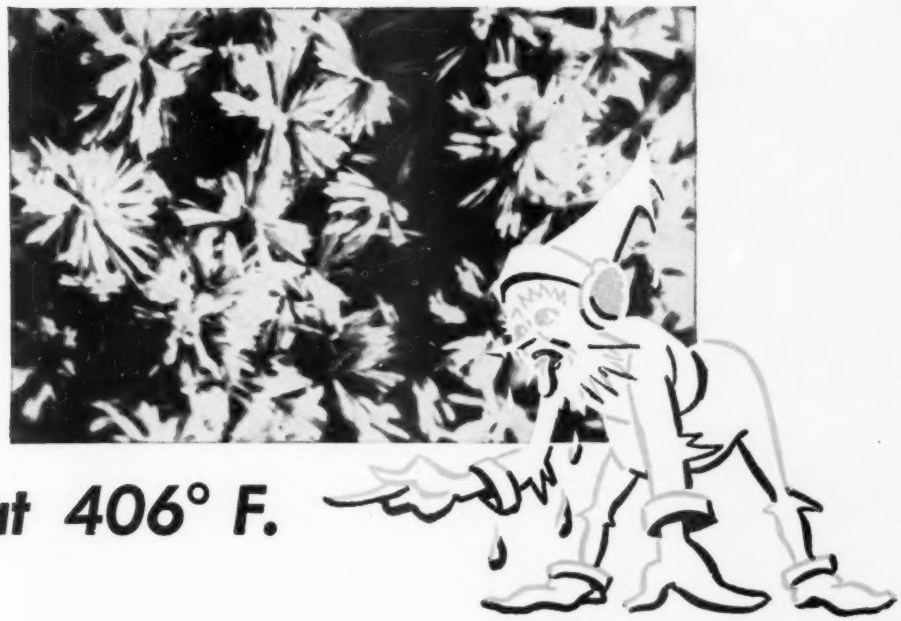
"The village fathers brought Jock in ten years before when they scrapped their old steam plant for two new diesel engines. So after years aboard steam and diesel, Jock had dropped his anchor to become a landlubber. Being chief of the local powerhouse, Jock was really a big fish in a small pond. After a few years he got to know those engines so well he could tell from the slightest change in running noise or rhythm exactly what needed attention.

"He might be mowing the lawn of his power plant—or of his cottage next door, which went with the job—when he'd stop and listen. Then he'd calmly walk into the plant. After a little while he'd be out puffing away on his pipe again, and start mowing.

"Jock was hard as cast iron, same as when we were shipmates. He boasted

(*Continued on page* 210)

JACK FROST



at 406° F.

MAGNIFIED fifty times, the calcium carbonate scale in the photo above might easily be mistaken for a frosted window pane. It was formed at 250 p.s.i. in one of the Nalco Laboratories' test boilers as a part of the continuing Nalco research program, aimed at keeping such scales *out* of your power plant equipment.

Whether your feedwater and plant conditions produce this type of scale—or any of hundreds of others—your Nalco Representative has the proved solution for eliminating scale or corrosion from raw water inlet to and through condensate return lines . . . permanently . . . economically. Check with him today—or write direct for fast action on your water treatment problems.

DO YOU RECEIVE "Nalco ABSTRACTS"?

"Nalco ABSTRACTS" is a quarterly publication containing abstracts of general and technical articles of interest to power plant engineers. If you, like most of us, find too little time to read, "Nalco ABSTRACTS" can be of real help in keeping you up-to-date on current developments. Your copies will be sent free upon request.

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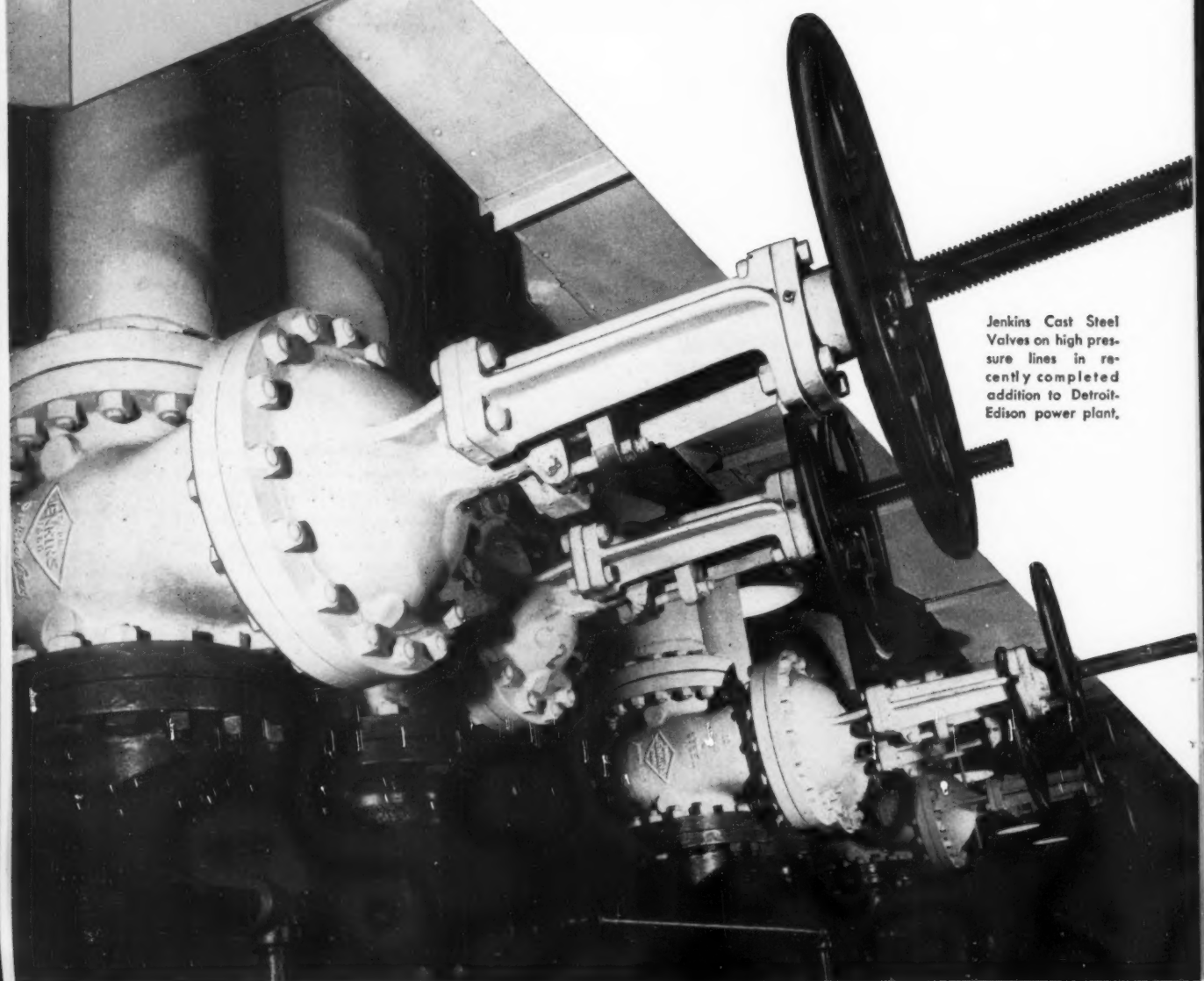

Jenkins Cast Steel Valves on high pressure lines in recently completed addition to Detroit-Edison power plant.

to meet today's need

. . . for dependable economy in higher pressure— higher temperature services

Mounting pressures and temperatures in power generation and industrial processing call for Cast Steel Valves. For this increasing need, Jenkins offers a wide selection of patterns that have met the test of the toughest services throughout industry.

In these valves, Jenkins provides a wide margin of strength and safety beyond ratings. Special refinements in design extend their service life, assure long, trouble-free performance. Resulting top efficiency and low maintenance records measure up to the high standards established for all valves developed by Jenkins Valve *specialists*.

Put Jenkins Cast Steel Valves at the valve-punishing control points in your plant and see how they set new standards for lasting economy. The new Cast Steel Valve catalog supplement gives complete information. Write for your copy today. Jenkins Bros., 100 Park Ave., New York 17.

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DEFENSE DIGEST

Your roundup of mobilization news and trends affecting power men

National Production Authority is now a permanent Commerce Dept agency. Business executives, on loan for 6-month rotation periods, will run its 20 main industry divisions. Regular industry advisory committees are being set up.

A production-controls division will run the Defense Materials System, successor to the Controlled Materials Plan (June Digest). It will issue directives to the mills, based on allotments certified by Defense Dept and Atomic Energy Commission and approved by Office of Defense Mobilization.

Uranium supply is no longer the limiting factor it was, says Gordon Dean, retiring chairman, Atomic Energy Commission. New deposits have been discovered in this country, Canada, Australia and elsewhere. New processes make it possible to tap low-grade sources in South Africa, phosphate regions of U.S.

With successful "breeding" of atomic fuel, these developments assure enough uranium to support a large-scale atomic-energy industry for generations.

Coal-bargaining time is September. John L Lewis is expected to ask for at least 10c-an-hour raise for his miners. Along with it, he is likely to demand a higher welfare-fund royalty – up from the current 40c per ton.

Price hikes on crude oil and some products have been eyed by Congress, but any backing down will come from economic pressure – heavy stocks and competition from natural gas, plus effects of record breaking imports of foreign oil.

Future of TVA may be settled next year. Water-power possibilities in the area are just about fully developed. If Congress finally decides to deny the big steam-plant program needed to firm up the system and meet growing industrial demands, TVA will have to buy power from adjacent private companies.

New oil-storage wrinkle is use of abandoned slate pits. Esso Standard has been surveying possibilities, has tentatively selected a Pennsylvania site that would handle summer storage of 3-million bbl of distillate fuel. Such storage would help level peaks and valleys of seasonal operation, also offers a good bet for safe stockpiling against national-defense needs.

Slate quarries get the nod because inert slate offers no contamination problems, pits are generally rectangular with vertical sides. Some form of cover, possibly a floating roof, would protect against sunlight, dust, animal life.

Eisenhower's choice for new head of AEC, Lewis L Strauss, has a record of interest in power-reactor research and development. His appointment is regarded as improving the prospects for industrial production of atomic energy.

Broad-base mobilization, subject of recent debate, has been reaffirmed by Defense Mobilization Director Flemming. New policy statement calls for: (1) standby production lines without actual volume production of anything easy to make when needed (2) expanded capacity for some items that are hard to produce and require long lead time.

A survey of all defense plants will see if some production can be shifted to cut costs. Tools of closed plants would be kept in place or stored. Budget still includes $500 million for stockpiling critical machine tools.

These huge natural gas engines, about 40 to a room, drive the generators, furnishing all the electricity used by Alcoa to produce 170,000,000 pounds of aluminum in this plant yearly.

800 BOXCARS OF AIR

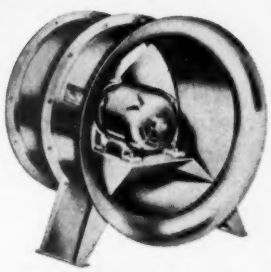
KEEP GENERATORS AT PEAK EFFICIENCY

Down at Point Comfort, Texas, a new kind of power plant was built a few years ago. 120 engines, running on natural gas, drive huge electric generators. Their job: to supply the current to smelt defense-needed aluminum. One of the biggest problems, though, was to keep the equipment running cool and thus at top efficiency.

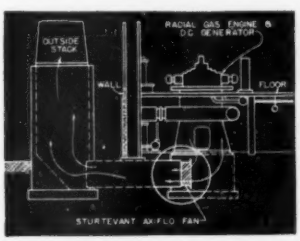
120 Westinghouse Axiflo® fans did the trick. Each draws 12,000 cubic feet of air through the generators every minute, picking up the excess heat. Then the air is piped through concrete ducts and out exhaust stacks which line both sides of the building.

Now Alcoa has just expanded this power plant. They have installed 74 new engines—and Westinghouse has supplied 74 more Axiflos. All in all, the 194 fans will move over 2,300,000 cubic feet of cooling air through the generators *every minute*. That's enough air to fill a trainload of 800 boxcars!

One day—today or in the near future—you may have a problem that involves *putting air to work*. When you do, remember that Westinghouse has the most complete air conditioning, air cleaning and air handling line in the industry. See the new Catalog 600. It contains 60 fact-filled pages on products, uses, and helpful data. To get your free copy, just call your local Westinghouse-Sturtevant office. Or, write to Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Mass.



Axiflo Fans keep them cool. They're compact, efficient, and trouble-free. That's important for hard-to-get-at jobs.



Cooling-air drawn through the engine generators picks up the intense heat, then safely exhausts it through individual stacks.

YOU CAN BE SURE...IF IT'S Westinghouse

J80281

AIR HANDLING

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POWER NEWS_____148
TECHNICAL BRIEFS_____150
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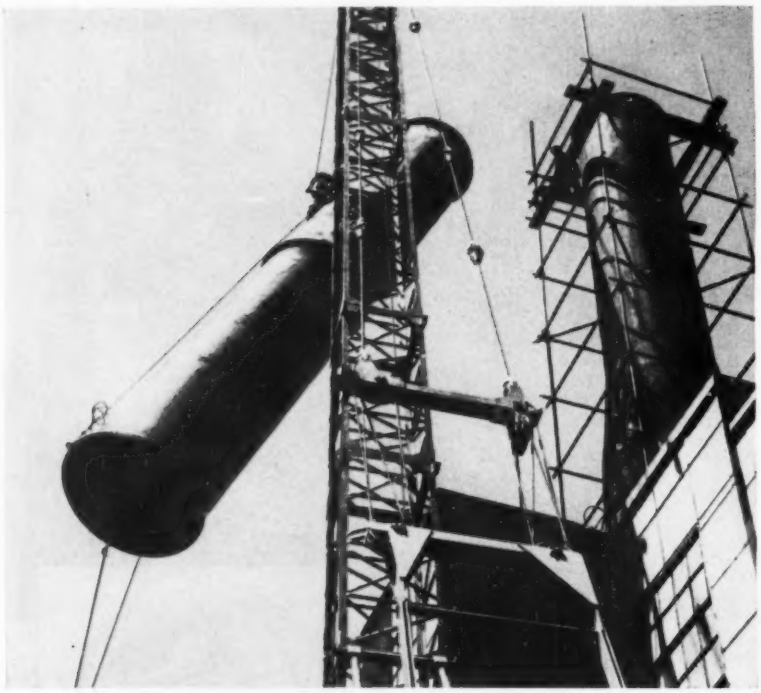
NEW FREE BULLETINS_____163



FIRST GLASS-LINED SMOKE STACK, built by A O Smith Corp, is now in service at Co's Milwaukee plant. Above 3-ton section will form top of 85-ft experimental stack

Ontario Hydro Plans Pumped-Storage Plant

► THE ONTARIO Hydroelectric Power Commission currently has under construction Sir Adam Beck-Niagara No 2 project. This is a 1,200,000-hp development scheduled for operation in 1954.

Water will be brought from above the Falls to the top of the cliff overlooking the plant at the river's edge near Queenston, Ontario. The water will be carried by (1) two concrete-lined tunnels 5.5 miles long and 45 ft in diameter and (2) an open canal 2.25 miles long.

(*Continued on page* 234)

For coming events see page 234

North American Builds Atomic Power Plant

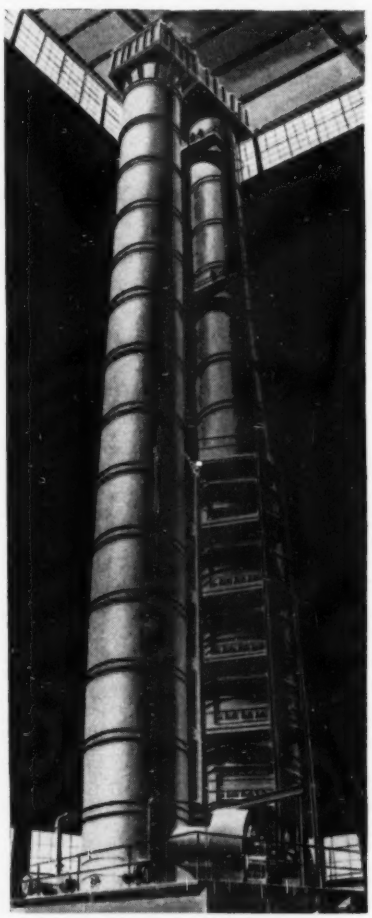
► ATOMIC POWER GENERATION moved closer to reality with the announcement that North American Aviation is ready to build a pilot plant. The company, working under contract with the Atomic Energy Commission, will use the new plant for producing electrical power for civilian use.

North American has already built a scale model complete with flashing lights, moving control rods and Geiger counters. Estimated cost for the plant itself is $10 million. Although certain phases of design are restricted, plans are available for inspection through the AEC by all persons and concerns cleared for access to classified data.

The pilot plant will generate power from the tremendous amount of heat produced during fission. Liquid metal will circulate through the reactor, absorb heat and then pass into an ordinary boiler to produce steam. The plant's output will be about 8000 kw—enough power to supply 2000 average homes. This power could be used for other atomic research at the site of the reactor.

Externally, the pilot plant will resemble an ordinary electrical power plant except for lack of coal, oil or other similar fuel-handling equipment. Unlike conventional installations, this new plant will produce neither smoke nor fumes. Although plant research and investigation will require additional scientists and engineers, routine operation of the new unit will require no more personnel than conventional plants. Special control devices and built-in characteristics of the design will provide the necessary safety factor.

At present, costs for producing electricity by atomic fission are higher than costs of conventional methods. However, the new development will provide valuable research that can help put such plants on a competitive basis. Also, atomic power generating plants enjoy a distinct advantage over conventional installations in areas where fuels such as coal, oil and gas are scarce.



WORLD'S TALLEST FURNACE is being built by Westinghouse Electric Corp. The 130-ft tower will heat treat aluminum pieces employed in aircraft construction

ALL FORGED STEEL

Edward UNIVALVES

Lower Pressure Drop 25-50% with Straight-Thru Flow

As shown photographically here, the streamlined internal contours and the inclined stem construction of the Edward Univalve give straight through flow — which careful laboratory tests have shown to result in pressure drop 25 to 50% lower for Univalves than other globe valve types. Turbulence, too, is greatly lowered by these streamlined contours. And lowering turbulence lengthens valve life by eliminating vibration, the principal cause of wear in small globe valves.

But lower-pressure drop and less turbulence are not the only reasons the Univalve has become an industry standard for tough high pressure, high temperature services. Here are just a few of the benefits which add up to longer life and lower maintenance for this outstanding all forged Steel Valve.

LONGER PACKING LIFE **through a positive backseat and deep cooling chamber which protects packing in service. Isolation of packing prevents blow-out when repacking under pressure.**

PERFECT ALIGNMENT, EASY DISASSEMBLY **when necessary, through foolproof patented body-bonnet connection.**

EXTRA WEARING SEATING SURFACES— **seat formed by application of continuous ring of Stellite to valve body; Stellite hard-facing applied to alloy steel disk.**

EASY PACKING ADJUSTMENT **with through bolted, accurately guided gland.**

EFFORTLESS SEATING **with Impactor handwheel in sizes 1¼ in. and larger.**

DESIGNED FOR HIGH-PRESSURE, HIGH-TEMPERATURE APPLICATIONS
Two different classes rated for 1500 lb sp at 1023F or 2500 lb sp at 1033F.

AVAILABLE IN A WIDE RANGE OF SIZES
Furnished in 1500 lb or 2500 lb pressure classes in sizes from ½ in. to 2 in.

CHECK VALVES, TOO
Check type Univalves, of spring loaded piston design, have the same basic construction as globe Univalves. Use them together for all welded construction for small pipe lines, eliminating all bonnet joint leakage problems.

IDEAL FOR BLOW-OFF SERVICES
Univalves meet all ASME code requirements for blow-off service and are adaptable for high pressure installations to 3120 psi boiler pressure.

Get the full story on Univalves, ideal all-purpose steel valves—write for Catalog 12G1.

Rod through Univalve demonstrates straight thru flow of this valve.

Edward Valves, Inc.
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TECHNICAL BRIEFS

Latest engineering developments for busy power men

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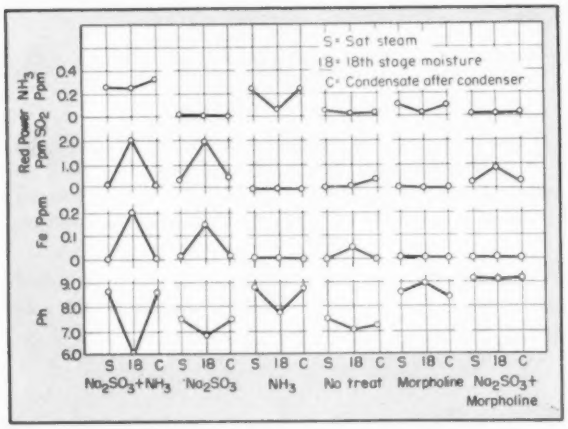
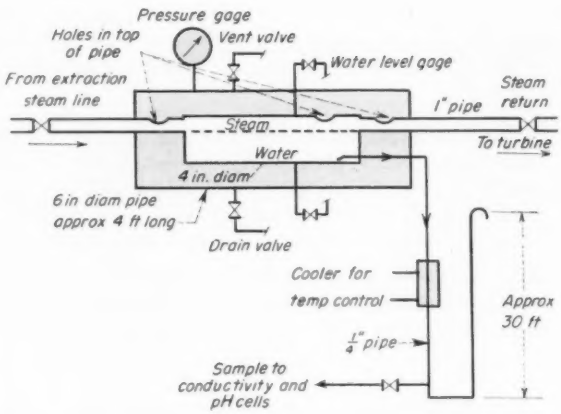


1 Potential metal pickup in the preboiler cycle by various suspected materials was the basis for above test curves



2 Special apparatus for running metal pickup tests, left, required removing condensate from steam before it cooled

Water Treatment Gets Heavy Attention

Prevention of Metal Losses in the Wet Steam Areas of Steam Turbines. *By F L Archibald and John W Purssell Jr, Boston Edison Co; Frederick G Straub, University of Illinois.*

This paper deals with the potential metal pickup in the various portions of the preboiler cycle from the initial point of moisture condensation in the turbine, through the condensers, heaters, pumps and economizers. It shows the effect of the various materials such as sulfur dioxide, hydrogen sulfide, carbon dioxide, oxygen, ammonia and organic amines on the metal pickup in the cycle. Stress is laid on the temperature and vapor pressure relationship of these materials at the points of condensation in the turbine and condenser. This has resulted in the modification of the chemical treatment to prevent metal pickup in the cycle. Some early experience in Hydrozine is also presented.

Early in 1952 a program of investigation was started at Mystic Station to study the effect of the various chemicals used in the water treatment on the iron pickup in the areas of metal loss. In order to determine the composition of the moisture as it forms in the turbine it was necessary to remove the steam water mixture from the machine and separate the water from the steam for further testing. It is important that the condensate be removed from contact with the steam before cooling to insure duplication of conditions within the turbine. The moisture was starting to form in the region below the 18th stage which was about 15 psia under full load on the turbine and down to 4 or 5 psia under low loads. The apparatus used for sampling is shown in Fig. 2, above. This allows for a continuous sample of the water separated from the steam to be cooled and then tested for specific conductance and pH before exposure to air. Samples could then be collected and analyzed for iron, ammonia and reducing power. The sampling equipment was constructed of 18-8 stainless steel in order to reduce iron contamination.

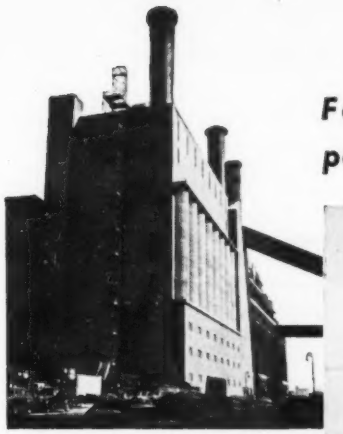
The results of the tests, Fig. 1, above, run with the regular water treatment in use, showed that when the pH of the steam leaving the boiler was around 9.0, the sample of water removed from the 18th stage of the turbine had a pH between 6 and 7 and the condensate at the condensate pumps had a pH around 9.0. The ammonia content was about the same at the three sampling points. Tests run to determine the reducing power of the steam showed almost a tenfold increase in the 18th stage sample with a marked increase in iron pickup. The reducing power was thought to be the result of liberation of sulfur dioxide from the sulfite in the boiler water, since it varied in proportion to the sulfite content of the boiler water. No hydrogen sulfide could be detected at any time.

These results indicated that the sulfur dioxide was concentrating in the liquid phase to form sulfurous acid. The ammonia was partially neutralizing the acid but was not present in sufficient amounts to increase the pH to the desired range. This decrease in pH in the liquid phase in contact with the metal in the turbine would tend to allow the iron to go into solution as the soluble ferrous hydroxide. When the temperature decreases and the liquid tends to be subcooled below its steam saturation temperature the ammonia dissolves in the liquid raising the pH. Thus at the condensate pump the pH approaches basic.

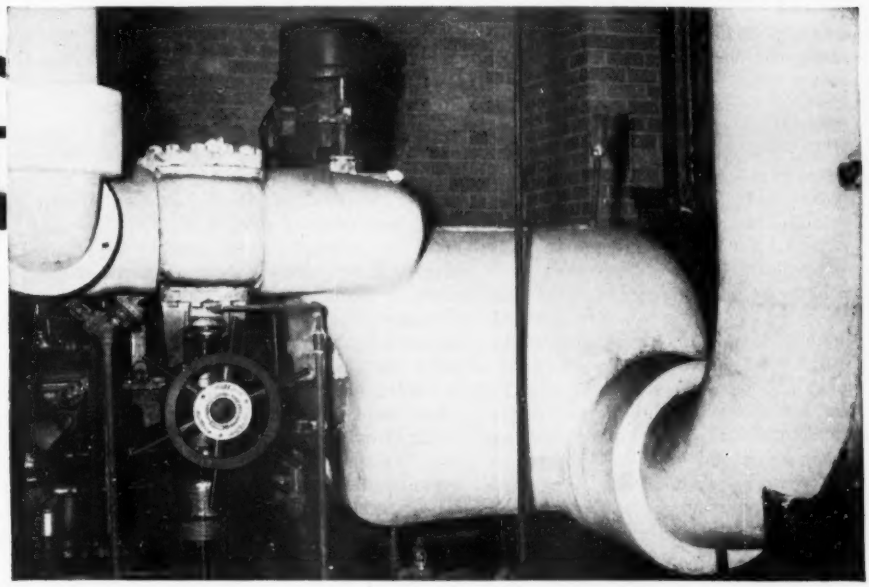
This increase in pH decreases the solubility of the ferrous hydroxide and causes the precipitation of the iron on the lower pressures blades and diaphragms and on the condenser tubes. Often it does not show as soluble iron in the condensate samples taken at the condensate pumps since it has already been precipitated out of solution.

Several of the chemicals being fed to the cycle were then varied in order to study their effect. Fig. 1 shows in graph form a summary of the results.

(*Continued on page* 152)



For this addition to their New York City power plant at East River and 14th Street...



(Above) View of recently completed annex to Consolidated Edison's power plant... another link in their gigantic expansion program. **(Right)** Close-up of J-M 85% Magnesia Insulation on boiler feed lines. It was expertly installed by the Asbestos Construction Company, Inc., an outstanding J-M Insulation Contractor.

CON EDISON SPECIFIES J-M 85% MAGNESIA PIPE INSULATION FOR MAXIMUM FUEL SAVINGS

Like all materials that went into the new power plant addition of New York's leading gas and electric supplier... the pipe insulation had to be the *best*. That's why Consolidated Edison Co. specified J-M 85% Magnesia... industry's No. 1 insulation for many decades and *still* the leader in its class.

J-M 85% Magnesia is the leading insulation on the market for temperatures up to 600F. It is bonded with asbestos fibers. This rugged insulation will not distort regardless of the length of time it stays in service. J-M 85% Magnesia fits snug and stays put. Heat savings, therefore, remain constant for the life of the equipment on which this insulation is applied.

For temperatures over 600F, J-M 85% Magnesia is used in combination with Superex*, a J-M insulation for service to 1900F. This double-layer construction, known as Superex Combination, eliminates through joints and protects the jacket against scorching. It also utilizes the higher heat resistance of Superex next to the hot surface, and the greater insulating value of J-M 85% Magnesia for the outer layer.

*Reg. U.S. Pat. Off.

Experience has proved that all insulations must be properly installed to pay maximum dividends. That's why Johns-Manville offers industry the services of experienced insulation engineers and installation contractors who have made a career of solving complex insulation problems. From coast to coast, these engineers and the contractor's highly skilled mechanics stand ready to combine their talents and give you an insulation job that will more than pay off your initial investment with maximum fuel savings through the years.

When you face your next insulating problem... remember that Johns-Manville is "Insulation Headquarters." Consult your near-by J-M Insulation Contractor... or write direct to Johns-Manville, Box 60, New York 16, New York. In Canada, write 199 Bay Street, Toronto 1, Ontario.

Skilled Applicators on the team of a J-M Insulation Contractor applying J-M 85% Magnesia to pipelines. Located throughout the nation, these contractors have had years of experience handling all types of installations. They know J-M 85% Magnesia and other J-M insulations as *quality* products, and take pride in applying them properly. Result: an insulation job that pays dividends through the years in maximum fuel savings.

Johns-Manville *FIRST IN* INSULATION

MATERIALS ENGINEERING • APPLICATION

More TECHNICAL BRIEFS

Begins on page 150

When the ammonia feed was stopped, the reducing power and iron content of the 18th stage sample were still high and the pH in the range 6 to 7. When the sulfite treatment was stopped but with ammonia treatment in use, the reducing power and the iron pickup both were almost zero. The pH varied from 8.8 (NH_3 0.25) in the steam to 7.8 (NH_3 0.05) in the 18th stage sample. When both sulfite and ammonia treatments were stopped, the reducing power and ammonia were low at all sampling points. The pH remained in the range 7.0 to 7.5 but there was some iron pickup in the 18th stage sample.

These results indicated that the best treatment, as far as iron pickup and the maintenance of a higher pH in the 18th stage, was with the ammonia treatment and without sulfite treatment in the boiler water. To operate under these conditions meant loss of reducing agent protection in the boiler water.

The work was then directed toward using a reducing agent other than sulfite. Hydrazine (N_2H_4) had been reported successfully used in low pressure installations in Europe and laboratory tests indicated that it was fairly stable at high steam pressures. Solutions of hydrazine in water are available in concentrations around 22%. This is a clear water white liquid that is easily handled. *APC Paper, no number.*

Use of Amines in Low Make-Up Steam Plant. *By H J Guillory, Central Louisiana Electric Co.*

All makeup (approximately 1%) for the author's company's Coughlin station comes from two bent-tube evaporators discharging their vapor into deaerating heaters. One of these evaporators discharge into the one deaerator serving Units 1 and 2. The other evaporator discharges into the deaerator for No. 3 or that for No. 4 Unit. An interconnected stystem of four 10,000 gallon condensate storage tanks provide maximum flexibility of make-up control. In addition to the conventional deaeration supplied by the heaters, all condensers are equipped with deaerating hotwells.

Initially, all feeds for these two evaporators were obtained from deep wells, located on the property, with no provisions made for softening or pretreatment of the well water. However, they were treated internally with phosphate, a lignin organic and sodium sulfite. The phosphate was fed at the deep well pump discharges for iron stabilization and the organic and sulfite "slug" fed to the evaporator shells. Later, continuous feed of these chemicals was resorted to which provided much better control. It may be of interest to note that only one evaporator has been cleaned mechanically in the five year history of the station. Subsequent inspections proves that cleaning by any means has been found to be unnecessary to date.

In the past few years we had noticed, in various publications pertaining to steam power plants, a growing interest and awareness of the problem caused by iron in high pressure, low make-up plants. With all of these factors in mind, and thinking that we should attack the problem before trouble occurred, it was decided to make some effort to minimize carbon dioxide and consequently, iron. After going into this problem thoroughly with both our water consultants and station designers, our belief was that the evaporator feedwater could best be treated for the removal of excess carbon dioxide with an acid regenerated zeolite, followed by degassification and neutralization with caustic soda. Consequently, in the latter part of 1950 such a unit was placed on order and put into operation in July of 1951. Results were immediately apparent as the carbon dioxide in the system was reduced to reasonable values. Soon after this unit was placed in operation, conductivity of the condensate at the hotwell was reduced to a steady 0.6 micromhos and carbon dioxide at the deaerator discharge decreased from approximately 3.5 to 1.5 ppm.

This program, primarily aimed at reducing corrosion in the system, was obviously a great step forward. While no serious problems had been encountered that could be attributed to corrosion only, we did experience considerable difficulty with heater drains. While internal conditions in the major equipment showed no unusual amounts of iron oxide deposits, we believed that it was possible to still further reduce corrosive tendencies prevailing in the water cycle and consequently the iron content of the system.

We had observed, in technical publications of the last few years, a tendency toward the increasing use of higher condensate pH values to further minimize corrosive tendencies prevailing in other plants. At that time we thought it feasible to consider four methods of further reducing the carbon dioxide and increasing the pH in the cycle. The author then summarizes the methods considered and reasons why they were discarded or accepted. *APC Paper, no number.*

TO OBTAIN COMPLETE TEXT

Material for these abstracts comes from the following sources unless otherwise stated. Order complete paper from sources, not POWER.

American Power Conference, annual meeting, Sherman Hotel, Chicago, Ill., Mar 24-27, 1953. Identified by initials APC and obtainable in proceedings printed and distributed by R A Budenholzer, chairman, Illinois Institute of Technology, 3300 Federal St, Chicago 16, Ill. $6.00.

American Institute of Electrical Engineers, winter general meeting, Statler Hotel, New York. N. Y., Jan 19-23, 1953. Identified by initials AIEE and obtainable through AIEE, 33 W 39th St, New York 18, N. Y.

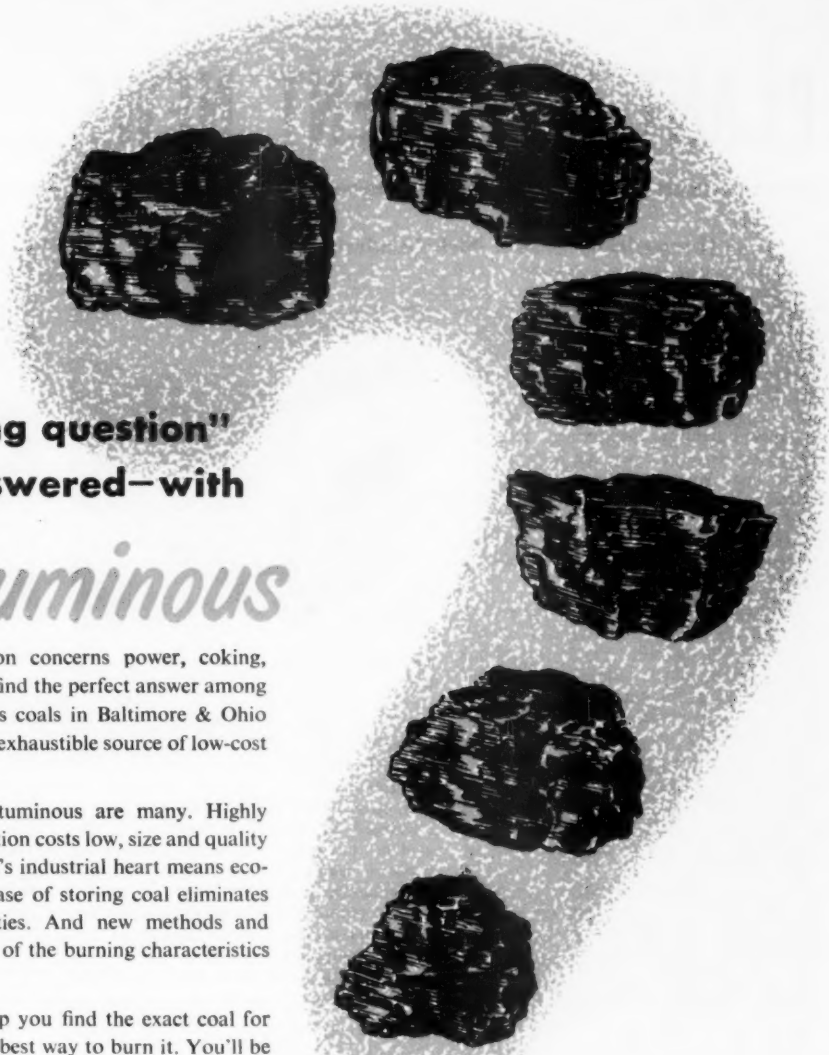
Manufacturing Chemists' Association, Inc, Water and Air Pollution Abatement Conferences, Oct 23-24, 1952, Netherland Plaza Hotel, Cincinnati, Ohio and Feb 26-27, 1953, Hotel Statler, Detroit, Mich. Identified by initials MPC and obtainable from Manufacturing Chemists' Assn, 246 Woodward Bldg, Washington 5 D. C.

Dealkalization of Boiler Feedwater in Small Power Plants. *By A E Kittredge, Cochrane Corp.*

Awareness of the need of alkalinity reduction gave leadership to the hot process precipitation type softener in preparing feedwater for industries requiring large volumes of treated water. When the need of alkalinity reduction was appreciated and demanded, the exchange type zeolite water softener lost its advantage of simplicity and economy since the only method of accomplishing alkalinity reduction with that softening process was, until recently, by use of acid either directly or through the use of acid regenerated hydrogen zeolites.

Alkalinity reduction by anion exchange is basically a process where practically all of the anions dissolved in a water supply are exchanged in the same way as in an ordinary zeolite water softener for the chloride ion of ordinary salt. Sodium softening exchanges all calcium and magnesium cations for sodium. Chloride dealkalization exchanges all bicarbonate and sulfates for chloride. The latter process produces a water supply having the

(*Continued on page* 214)



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Whether your specific question concerns power, coking, steam, or space heating, you'll find the perfect answer among the wide variety of Bituminous coals in Baltimore & Ohio territory. Here lies an almost inexhaustible source of low-cost heat and energy.

The benefits of B&O Bituminous are many. Highly mechanized mines keep production costs low, size and quality uniform. Closeness to America's industrial heart means economical transportation. The ease of storing coal eliminates the need for expensive facilities. And new methods and devices take further advantage of the burning characteristics of Bituminous.

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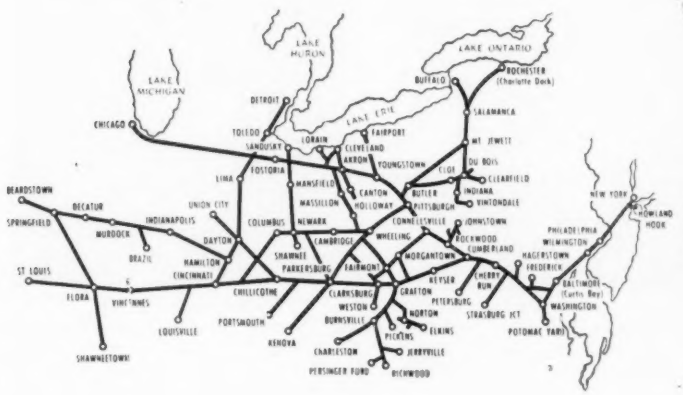


BALTIMORE & OHIO RAILROAD

Bituminous Coals for Every Purpose

PLANT EQUIPMENT NEWS *Your information center*

Hermetically Sealed Nickel-Cadmium Battery Boasts Long Life, Little Maintenance

838 • New dc standby power unit, the *Voltabloc*, uses sealed nickel-cadmium batteries of the type adopted by the Navy Bureau of Aeronautics for military aircraft use. The power unit is suitable for switchgear operation, supervisory control and emergency lighting, particularly in unattended substations. Since the batteries are sealed there is no need to add water periodically. The sealed feature also eliminates need for forced-air ventilation. This unit, a newcomer in the U. S. industrial field, was developed by the SAFT organization in France.

The "standard" 125-volt unit has a cabinet with space for five batteries plus a rectifier. Each *Voltabloc VO-35* battery has 20 cells, nominally develops 24 volts for 35 ampere-hours. Battery net weight is 88 lb, dimensions are approximately 15.4 x 9.8 x 7.9 in.

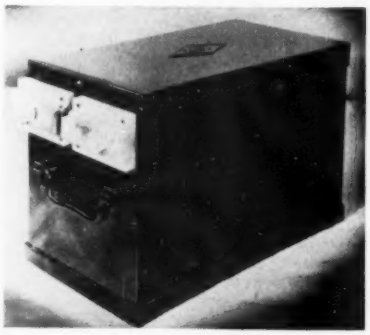
These special advantages are claimed: high charge/discharge efficiency; no gassing; low internal resistance; little variation of effective capacity as a function of discharge rate; reduced weight and size.

The plates have a steel core, sintered with a hard, porous nickel alloy. The active positive and negative materials are electroplated into pores of the nickel alloy, where they come in contact with the electrolyte.

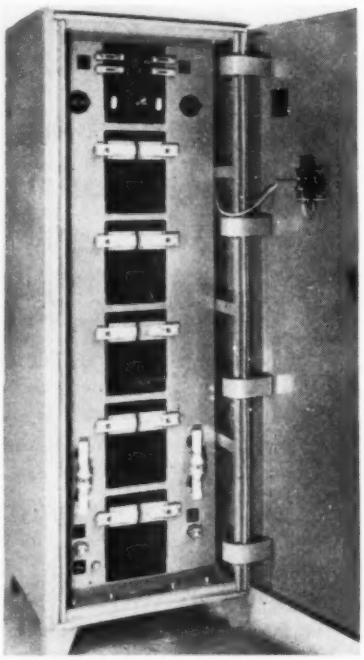
Manufacturer states that unit is suited either for furnishing considerable power for several seconds or minutes or for supplying power for one or more hours. It is also claimed that battery may be discharged at any rate without ill effects.

A completely discharged battery can be recharged in 10 hours. Overcharges are said not to be harmful, unless temperature becomes too high. Batteries can be used immediately, or put into stock for an unlimited period without special precautions, regardless of the state of charge or discharge, manufacturer claims.

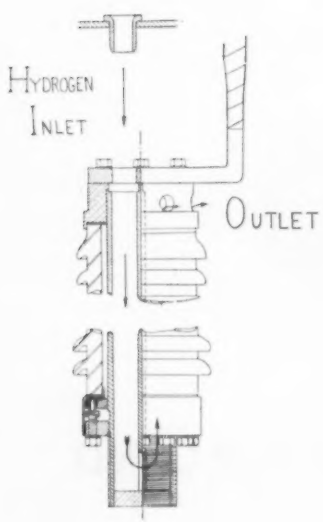
Cogenel, Inc, 230 Park Ave, New York 17, N. Y.



BATTERY is hermetically-sealed alkaline unit, said to need no maintenance



CABINET has six compartments; top one holds rectifier, others the batteries



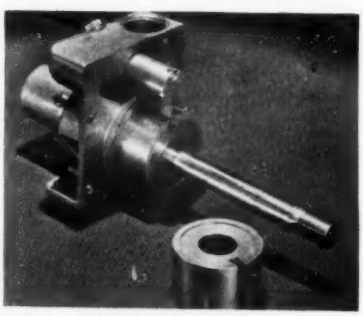
Jet-Cooled Bushing

825 • New jet-cooled terminal bushing for hydrogen-cooled steam turbine-generators increases current capacity of conventional bushings nearly 4 to 1 while maintaining a compact, mechanically sturdy conductor and bushing design, manufacturer claims.

The terminal conductor is a hollow copper stud, divided into inlet and outlet passages by a vertical partition. A jet of hydrogen is forced from the generator pressure chamber at high velocity, and directed through a hole in top of the bushing. It travels through the passages in direct contact with conductor copper and exhausts into the generator fan suction region through radial openings in the bushing cap.

Manufacturer's tests indicate that with jet cooling a 4500-amp bushing can safely carry 17,500 amps with hydrogen pressure at 30 psig. At 0.5 psig hydrogen, the bushing will carry over 10,000 amps.

Allis-Chalmers Mfg Co, General Machinery Div, Milwaukee 1, Wis.

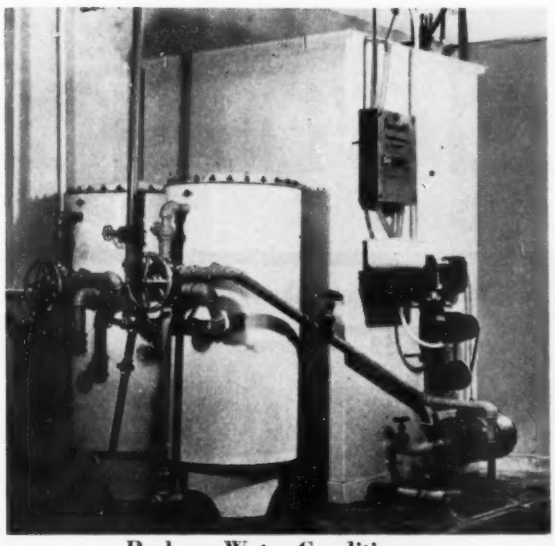


Lubricant Pump

805 • Bronze-impeller positive-displacement pump handles oils and greases from light-bodied fluids to heavier diesel lubes and rendered fats. Maximum capacity is 10 gpm.

The units are self-priming at low temperatures, can operate at oil temperatures up to 500 F. They may be operated submerged, will pump in either direction and in any position.

Eco Engineering Co, 14 New York Ave, Newark, N. J.

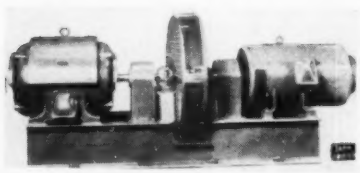


Package Water Conditioner

815 • Unit is available in eight standard sizes from 500 to 3300 gph, and flows of 12,000 to 79,200 gallons per day. Each complete conditioner consists of a precipitator with built-in clearwell, proportioning chemical feeder control, coagulant feeder tank, lime or soda ash hypochlorite feeder tank, inlet float control valve, *Neutralite* filter unit, *Carbo-Dur* purifier unit and service pump.

The units may be used to remove turbidity, color and organic matter from water supplies, to chlorinate, to remove bad tastes, odors, iron and manganese, to neutralize, soften and de-alkalize.

Applications include municipalities, factories, power plants, etc. **Permutit Co, 330 W 42nd St, New York 36, N.Y.**



Flywheel Motor-Generator

834 • Flywheel generator sets and associated emergency transfer control insure continuity of power supply for microwave equipment on utility, pipe line and similar long-distance systems.

During normal operation, set runs on commercial power system. When there is a disturbance or outage, energy stored in the flywheel drives the generator for seven seconds. This allows time for automatically starting an emergency standby generator set and switching the microwave equipment to the emergency power source. Publication 200-FF-22.

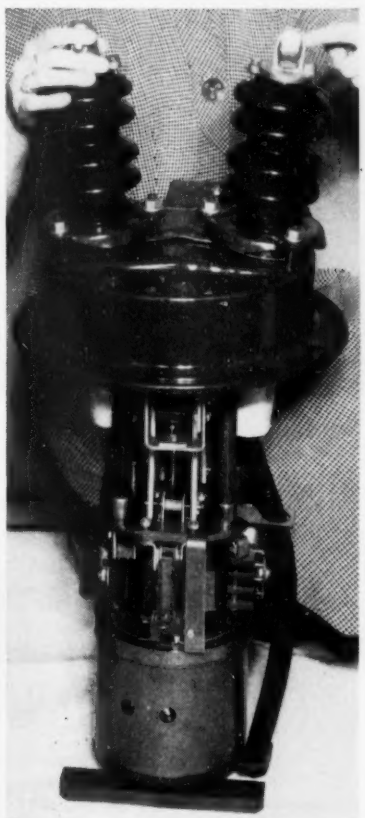
Electric Machinery Mfg Co, Minneapolis 13, Minn.

Conveyor Belt Guides

816 • Conveyor *Guidler* serves as an idler as well as a guide. When installed at a 30-degree angle, it presents a revolving hyperbolic face to the belt edge. Impact force is thus distributed over a relatively long, flat surface, and injury to belt edges is avoided. The *Guidler* is also said to move along its axis and thus follow the vertical movements of the belt edge, controlling it while rising. **Knapp Mills Inc, 23-17 Borden Ave, Long Island City 1, N.Y.**

Film-Forming Amine

801 • *Hagafilm* is said to reduce corrosion from oxygen and acid carbon dioxide in steam condensate systems. The amine is fed to the boiler in quantities of 2 or 3 lb per million lb of steam. It vaporizes with the steam and deposits a thin, non-wettable protective film on all metal surfaces where condensation occurs, and throughout the return system. May be obtained in both solid and liquid form. Bulletin available. **Hagan Corp, Pittsburgh 30, Pa.**



Oil Circuit-Recloser

812 • New type FR line of oil circuit reclosers has a one-way seal for moisture protection, permitting release of internal pressure but preventing moisture-laden air from entering the recloser. Units of the new line are available with a time-current characteristic that allows interchangeability with other makes.

The line includes single and three phase units, 5 to 140 amps, current rating, 2400 to 14,400 v, 125 to 2500 amps interrupting capacity.

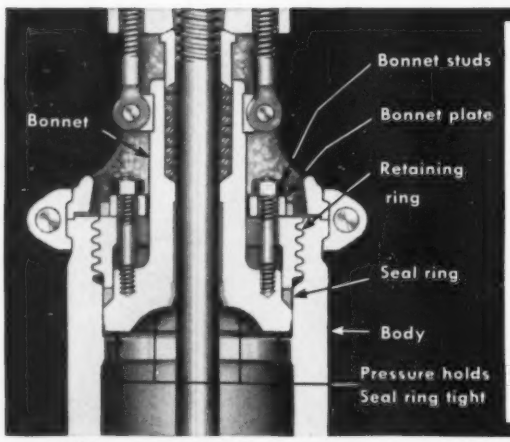
General Electric Co, Schenectady 5, N.Y.

(*Continued on page* 158)

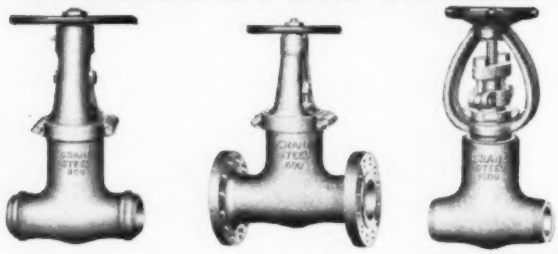
For more data on these items, use post cards p. 163. Identify your request with item number.

CRANE HIGH-PRESSURE PIPING

modern as



CRANE PRESSURE-SEAL BONNET GATE VALVES



Butt-Welding Ends. 600, 900, 1500-Pound

Flanged Ends. 600-Pound only

Socket-Welding Ends. 1500-Pound only

CRANE PRESSURE-SEAL DESIGN

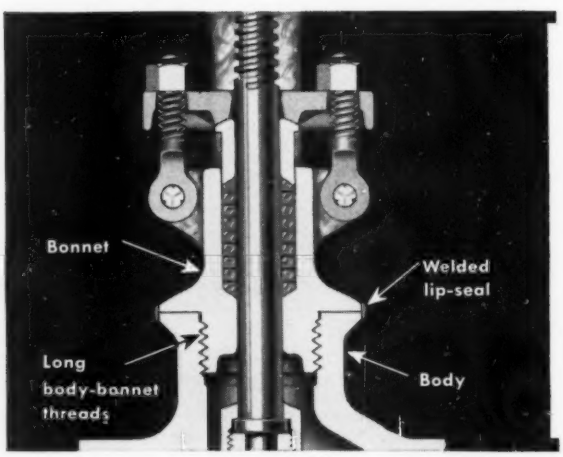
Valve sizes 1 to 24-inch

The bonnet joint is inside the valve and the sealing element is a wedge-shaped seal ring. Internal fluid pressure, acting upon the entire underside of the bonnet, forces the bonnet against the seal ring between the body and bonnet, forming a pressure-tight metal-to-metal joint. Thus maintenance of the joint is minimized, although the assembly is readily dismantled for inspection and just as readily reassembled.

CRANE LIP-SEAL DESIGN

Valve sizes ½ to 2-inch

Valve body and bonnet are screwed together until a firm metal-to-metal contact is made between the smoothly machined flat surfaces on the top of the body. The small lips around the periphery are then seal welded. The threaded members alone carry the mechanical load—and at comparatively low stresses. The seal weld handles the easy, but very important, job of sealing against leakage. With ordinary care, the seal may be repeatedly ground off and rewelded. Ask for Circular AD1902.



THE BETTER QUALITY . . .

CRANE

VALVES • FITTINGS

Progress comes when you turn disadvantage into advantage. And that's what Crane accomplishes in the revolutionary Pressure-Seal Bonnet Valve. For line pressure is no longer a force to contend with, but a force that works to keep the bonnet joint tight against leakage—and free from maintenance. Here, too, is weight-saving, space-saving design with excellent flow characteristics. Materials are the finest available. In fact, no other valve can match Crane Pressure-Seal dependability in high-pressure, high-temperature services. But there's still another notable Crane steel valve—the smaller, companion Lip-Seal Valve, providing the same advantages as its bigger brother through a unique threaded joint and a welded lip seal that carries no mechanical load. Complete data on both lines is in your Crane Catalog, or ask for literature.

Write today for new Pressure-Seal Valve Circular, AD1936.

tomorrow

... GLOBES AND ANGLES

Globe, Socket-Welding or Butt-Welding Ends. 1500-Pound only

Angle, Socket-Welding Ends. 1500-Pound only

... AND STOP-CHECKS

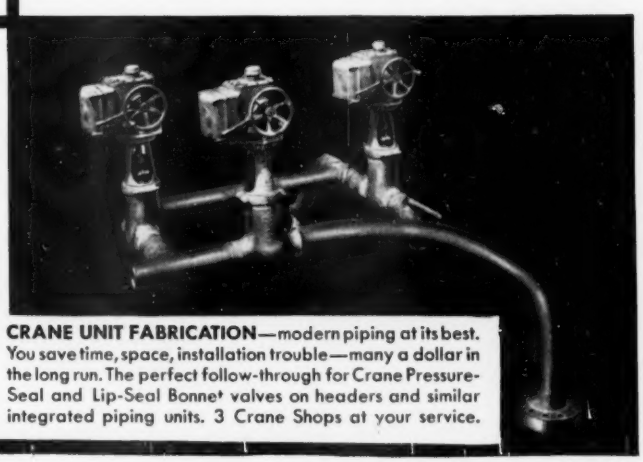
Globe Y-Pattern, Butt-Welding Ends. 900 and 1500-Pound

Angle, Butt-Welding Ends. 900 and 1500-Pound

CRANE LIP-SEAL BONNET GLOBES AND ANGLES

Globe, Screwed or Socket-Welding Ends. 1500 and 2500 Pound

Angle, Screwed or Socket-Welding Ends. 1500 and 2500-Pound



CRANE UNIT FABRICATION—modern piping at its best. You save time, space, installation trouble—many a dollar in the long run. The perfect follow-through for Crane Pressure-Seal and Lip-Seal Bonnet valves on headers and similar integrated piping units. 3 Crane Shops at your service.

BIGGER VALUE LINE...IN BRASS, IRON, STEEL

VALVES

CRANE CO., *General Offices:*
836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

• PIPE • PLUMBING • HEATING

More EQUIPMENT NEWS

Begins on page 154

New Wire Ropes Have Plastic or Spring Cores

803 • Solid plastic-core wire ropes, *left*, serve some conditions better than hemp-center ropes. Except for the core, they are similar to ordinary wire ropes.

The plastic core is not affected by moisture, acid, caustics or other destructive agents found in many applications and the cores retain their resiliency over a long period. These ropes are available from ⅜ to several inches in diameter, with 3 to 8 strands of 19, 25 or 41 wires each. They were developed for use in cable-tool drilling of oil and gas wells but are applicable to many other industrial uses.

Another new wire rope made by the same company has a closely-coiled steel spring for its core, *right*. The spring gives greater strength against crushing, plus the flexibility of a hemp core.

Because of the hollow spring center this rope can hold a large amount of lubricant, keeping inner parts from rusting and wearing. It returns readily to original shape and diameter when unloaded.

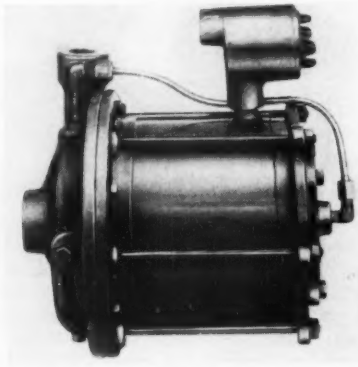
This rope is available in ⅜ to 2 in. diameters, and can be built in most wire rope constructions. It was developed for oil and gas well rotary-drilling rigs, but can be used for most other applications where wire or hemp-center ropes are applied.

Jones & Laughlin Steel Corp, Gateway Center, Pittsburgh 30, Pa.

Condensate Pump

845 • New condensate pump does not require a pit even though return pipes are as low as a foot above the floor. Unit handles 8000 sq ft of radiation at 20 psi. Pump is all-bronze centrifugal construction, connected through a flexible coupling to a ¼-hp single-phase motor.

Walter H Eagan Co, Inc, 2336 Fairmount Ave, Philadelphia 30, Pa.



Chemical Pump

814 • New fractional horsepower *Chempump* is recommended for handling corrosive, radioactive, and highly volatile fluids, and for vacuum processes.

Basic principle permits the fluid being pumped to enter part of the motor. Stator and windings are isolated from the fluid by a corrosion-resistant, non-magnetic alloy cylinder inserted in the air gap. The rotor is hermetically sealed with the same alloy. Bulletin G 1000.

Chempump Corp, Station D, 1300 E Mermaid Lane, Philadelphia 18, Pa.

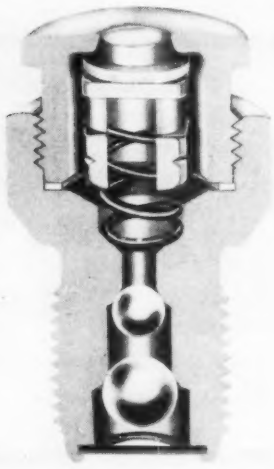
For more data on these items, use post cards p. 163. Identify your request with item number.

Duct Liner

846 • Flexible Fiberglas liner for air conditioning or warm air ducts has high noise reduction efficiency and thermal insulating properties. When used inside ducts, metal surfaces act as a vapor barrier.

Liner may be cut to match size of unformed sheets and adhered to the sheets which are then formed, producing duct with liner already installed. Light neoprene coating on liner prevents erosion by high-velocity air, reduces frictional losses.

Owens-Corning Fiberglas Corp, Toledo 1, Ohio



Triple-check Lube Fitting

847 • This lubrication fitting features two ball checks augmenting the standard check valve at the top, thus giving protection against escape of line fluids and making it practically impossible for foreign matter to foul all checks at the same instant. Unit is especially designed for use on lubricated plug valves, where extreme pressures are encountered.

The triple check fitting replaces the lubricant screw, so lubricant may be injected into the valve directly from a hand gun or bucket pump, cutting lubrication time.

Stewart-Warner Corp, 1826 Diversey Pkwy, Chicago 14, Ill.

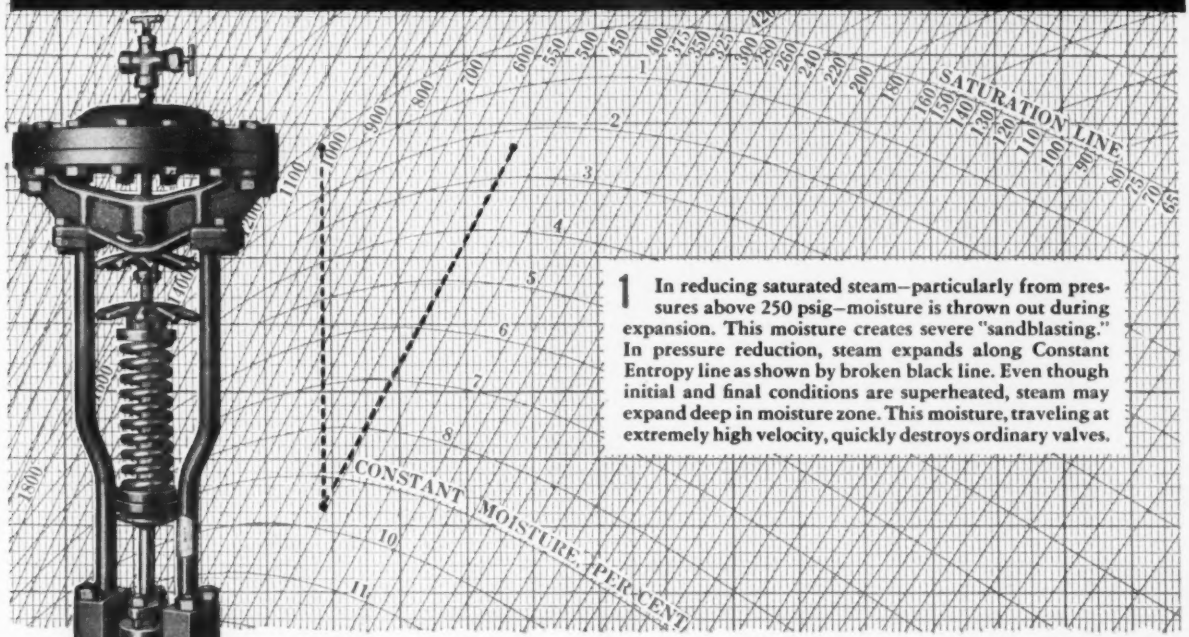
Hard-Surfacing Electrode

835 • Type W-98 electrode is a heavy-covered flame-hardening rod that can be used in all positions. Arc is of the steady-spray type. The electrode is designed for build-up work and hard surfacing applications where the deposited metal can be machined or flame hardened. Manufacturer recommends it where a higher hardness deposit is desired than that obtainable with electrodes used for under layers. Hardness is generally approximately 250 Brinell as welded, and is said to flame harden to about 350 Brinell.

General Electric Co, Schenectady 5, N. Y.

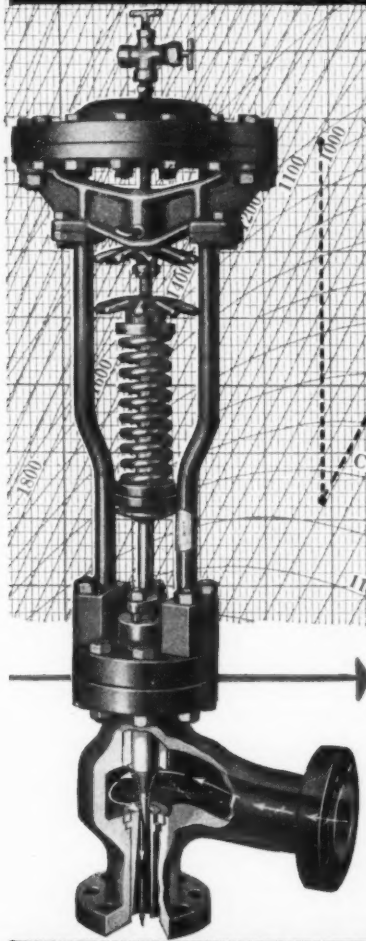
(*Continued on page* 160)

Swartwout V-10 Flow Regulating Valves slash maintenance costs in systems with high pressure drop or flashing condensate



1 In reducing saturated steam—particularly from pressures above 250 psig—moisture is thrown out during expansion. This moisture creates severe "sandblasting." In pressure reduction, steam expands along Constant Entropy line as shown by broken black line. Even though initial and final conditions are superheated, steam may expand deep in moisture zone. This moisture, traveling at extremely high velocity, quickly destroys ordinary valves.

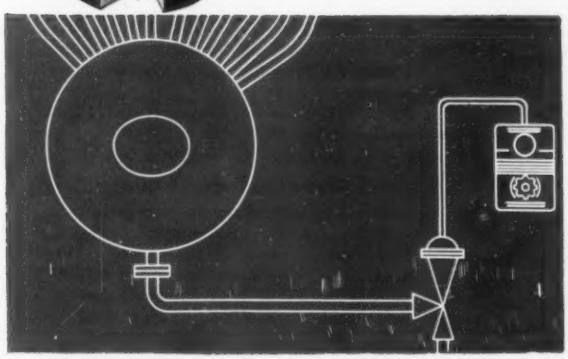
Chart from *Thermodynamic Properties of Steam* by Keenan & Keyes. Reproduced by permission of John Wiley & Sons, Inc., Publishers



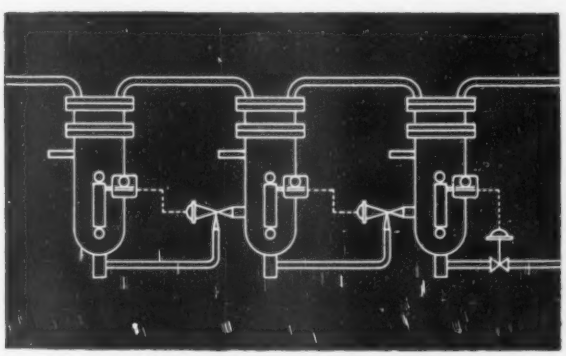
2 Swartwout V-10 valves are scientifically designed to handle liquids at high pressure drops and also under *flashing conditions.* All direct impingement is eliminated and longer valve life is assured two ways—by better flow design, plus use of materials specifically selected for the service involved. As a result, ***Swartwout V-10 valves outperform other valves in similar service.***

Swartwout

POWER PLANT EQUIPMENT



3 High pressure boiler blowdown service is extremely rigorous. When closed, there is full pressure drop across valve; when open, high velocities and flashing rapidly increase line loss and decrease the allowable drop across the valve. The variations in pressure make this service critical since valve must handle all conditions.

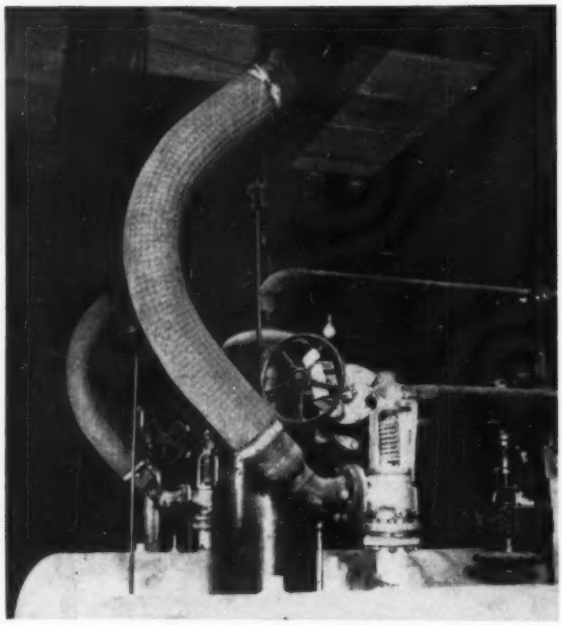


4 In saturated liquid drainage service, such as on high pressure extraction type heaters, water at saturation temperature flashes into steam when pressure is reduced. Exclusive scroll inlet and gradually expanded straight outlet of V-10 valve design permit a sliding action instead of direct impingement thus preventing corrosion-erosion. A-4286

SEND FOR BULLETIN S-208A • THE SWARTWOUT COMPANY, 18511 EUCLID AVENUE, CLEVELAND 12, OHIO

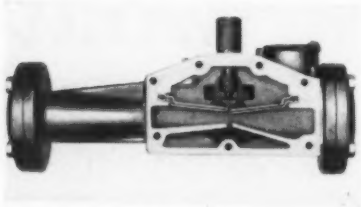
More EQUIPMENT NEWS

Begins on page 154



Flexible Safety Valve Exhaust

824 • Corrugated, flexible metal hose assembly is said to eliminate extreme noise and possible injury to workers caused by unexpected safety valve discharge. The flexible assembly is attached to the safety valve and extends to the exhaust pipe. When valve blows, the sealed unit absorbs sound, heat and vibration.
Flexonics Corp, 1301 S Third Ave, Maywood, Ill.

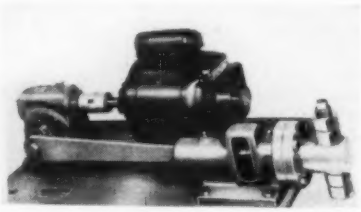


Air-Gas Mixer

827 • *Vari-Set* combustion air-gas mixer has an adjustable air jet to facilitate handling various burner requirements. Adjustable venturi throat is built into the mixer. Gas selector can be set for any type of fuel from manufactured gas to butane.

Unit can be adjusted to take care of operating conditions like pipe roughness, gas pressure losses in elbows, burner port variances, etc.

Available in four assemblies: basic, type VS; basic unit with air control, VSB; basic unit with gas valve, VSG; and basic unit with gas and air control valves, VSBG. Bulletin L-700.
Eclipse Fuel Engineering Co, Rockford, Ill.



Proportioning Pump

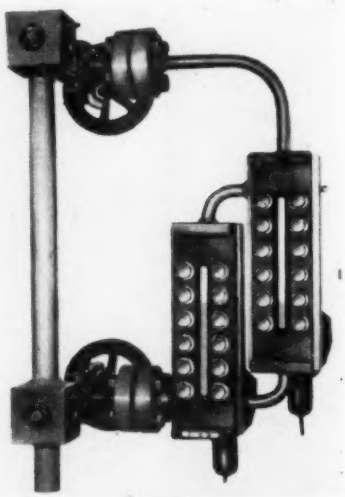
818 • New line of proportioning pumps meters precise quantities of viscous materials, slurries, suspended solids and corrosive liquids from 0 to 100 gph at 1200 psi. Special units available up to 300 gph, at pressures to 20,000 psi.

Automatic controlling devices can adjust capacity while pump is operating, and all models can be made with special metals, oversized valves, water seals and motors to meet particular operating conditions. Dual suction and discharge spring loaded valves have ball checks, and packing can be changed without breaking the unit's piping connections.
Walter H Eagan Co, Inc, 2336 Fairmount Ave, Philadelphia 30, Pa.

For more data on these items, use post cards p 163

CHECK THESE TOO!...

Tubular schaffold ..... p 170
Standard unit rectifier ..... p 174
Diesel engines ..... p 176
Voltage tester ..... p 178
Vertical action starter ..... p 184
Bin-level indicator ..... p 186
Flow detector ..... p 188
Zeolite cleaner ..... p 190



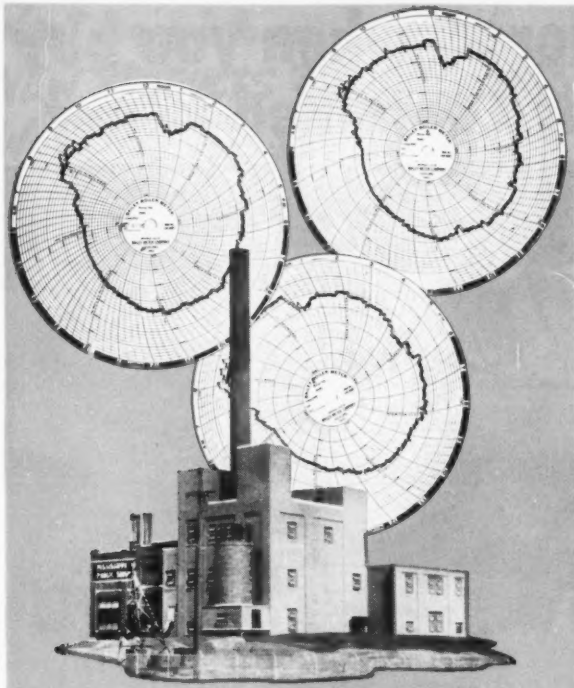
Water Gage Assembly

804 • New separated-design water gage assembly for high-pressure service uses pressure-sealed "floating assembly" gage glass inserts. On gages for wide range of visibility two independent inserts and interconnecting expansion loops are used. For medium ranges, one insert and a single expansion loop is used. Stuffing boxes are eliminated by using a lower flanged connection and an upper flanged loop. The short lower flanged connection eliminates the cold water leg. Advantages claimed are greater dependability, longer gage life, more accurate readings.
Yarnall-Waring Co, Chestnut Hill, Philadelphia 18, Pa.

Corrosion-Proof Linings

823 • Company offers chemical-proof construction service including fabrication, lining and assembly of all types of tanks, ducts, pipe, covers, scrubbers and miscellaneous fabricated items. Rubber, neoprene type rubber, Koroseal, Saran rubber, Heilex 445 (plastic), lead, ceramic brick, structural plastics are available. Where an acid- or corrosion-proof lining is required, this is said to permit selection of the best material for the application, based on field and laboratory tests. Work is done in the company's Cleveland plant. Bulletin 460.
Heil Process Equipment Corp, Attention E Vereeke, 12901 Elmwood Ave, Cleveland 11, Ohio

(*Continued on page* 170)



CONSISTENT EFFICIENCY

AT ALL LOADS

with Detroit Stokers at Mississippi Valley Public Service Company, Winona, Minnesota

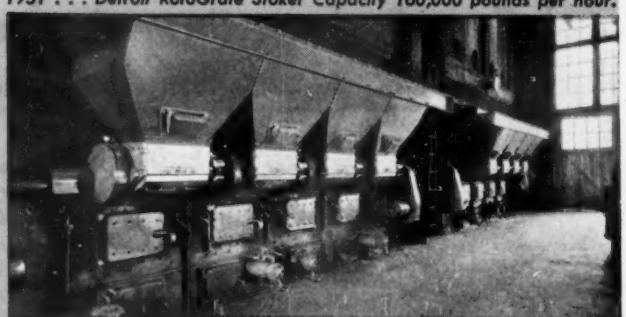
To meet increased demands for power, Mississippi Valley Public Service Company of Winona, Minnesota, added a new 160,000 pound per hour unit in 1951. It was only natural that a Detroit RotoGrate Stoker was selected for this larger boiler after their successful operation of 50,000 pound capacity Detroit RotoStokers installed ten years previously.

The new Rotograte has proved thoroughly dependable. It is efficient at any load and fluctuations are handled without appreciable pressure drop.

Detroit Spreader Stokers have built up a reputation for high efficiency and exceptional dependability since first introduced in 1931. They burn any Bituminous coal or Lignite without special preparation. Little power is required for operation . . . maintenance costs are low . . . availability is high.

There is a type and size Detroit Stoker to save *you* money and improve *your* operation. Let us make recommendations—no obligation.

1951 . . . Detroit RotoGrate Stoker Capacity 160,000 pounds per hour.



1941 . . . Two Detroit RotoStokers Capacity 50,000 pounds per hour each.

DETROIT STOKER COMPANY

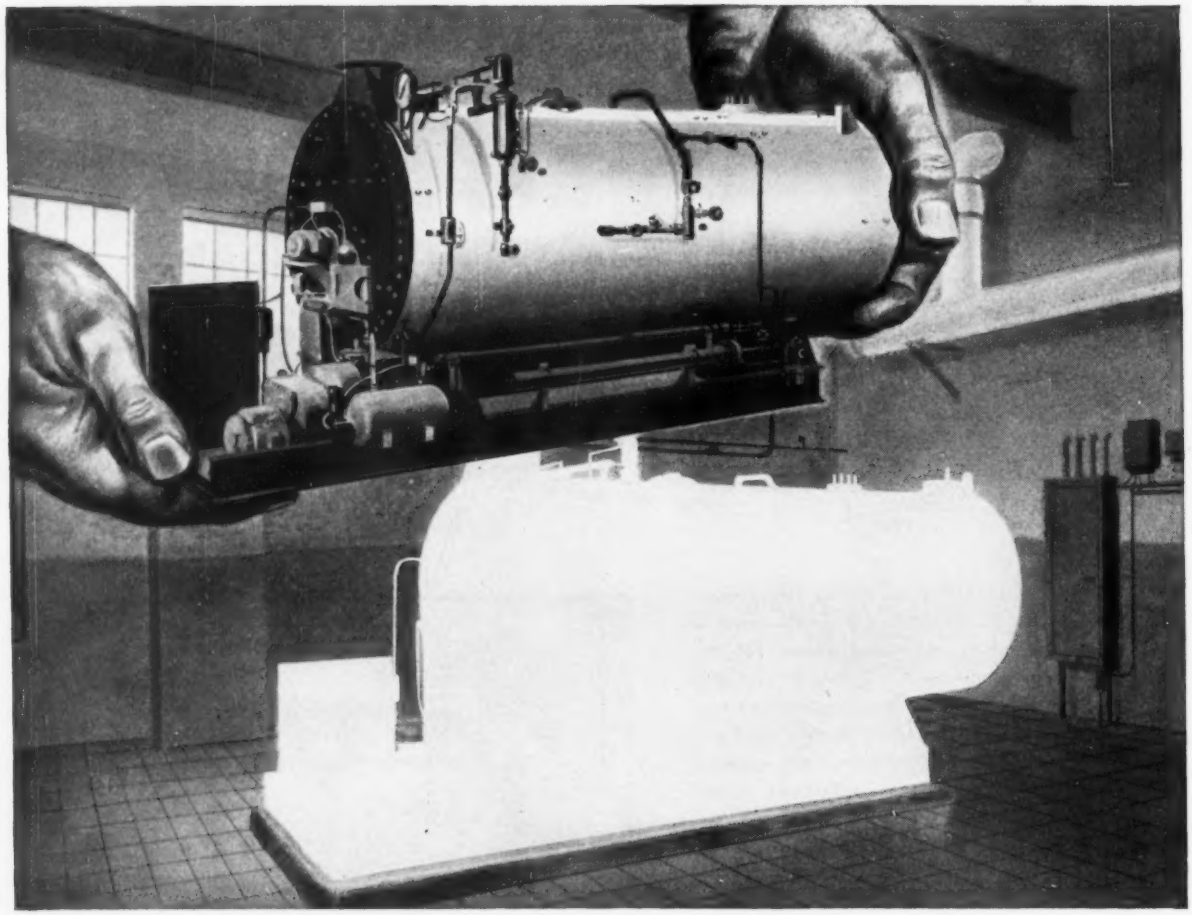
GENERAL MOTORS BUILDING • DETROIT 2, MICHIGAN

Works at Monroe, Michigan • District Offices in Principal Cities

DETROIT SINCE 1898 STOKERS

6164

Here's why you get more...when you buy a Cleaver-Brooks Self-Contained Boiler



...only Cleaver-Brooks can offer you the experience gained from more than 20 years of pioneering . . . and more than 12,000 individual "packaged" boiler installations

CLEAVER-BROOKS pioneering has been largely responsible for simplifying boiler buying . . . lowering costs of installation . . . delivering 80% guaranteed steam efficiency from every fuel dollar.

Boilers can be shipped as completely assembled and tested self-contained units, with auxiliaries as required. Installation involves minimum of time, construction and space. Usually connections only to steam, fuel, water lines and electrical service are needed. No special foundations are required. A short vent takes care of exhaust gases. Frequently, boilers are ready for use in a matter of *hours*, depending on availability of service lines.

Cleaver-Brooks, originators of the self-contained boiler, offers wider experience that counts in another important way. Qualified engineers help you plan steam plants tailored *exactly* for your needs. Carefully analyzed are loads, space and equipment arrangement. This not only helps you solve present steam needs, but adds flexibility for future expansion as well.

This application engineering, plus basically sound design and construction is your assurance of a full return from your boiler investment. When you specify a self-contained boiler — make sure it's a Cleaver-Brooks.

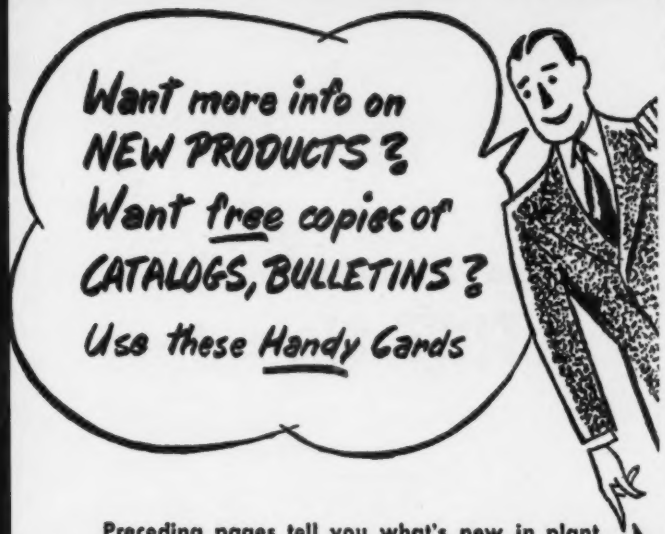
Send for Catalog AD-100 for full details on Cleaver-Brooks boilers. Available for oil, gas and combination oil/gas firing. Sizes 15 to 500 hp, 15 to 250 psi — for heating and processing.

CLEAVER-BROOKS COMPANY
Dept. J, 301 E. Keefe Ave.
Milwaukee 12, Wisconsin, U.S.A.

Cleaver-Brooks

ORIGINATORS OF THE SELF-CONTAINED BOILER

Steam Boilers • Oil and Bitumin Tank Car Heaters • Distillation Equipment Oil and Gas Fired Conversion Burners



Preceding pages tell you what's new in plant equipment. Each item is numbered. For more info on any of them, write in their numbers here

New free catalogs and bulletins are listed beginning on back of this page. To order those you want, write in their item numbers here

Put 2¢ stamp on self-addressed card and mail it to us. We'll pass along your requests to the various companies, they'll send the info

Want quick direct-from-manufacturer service?

USE THESE CARDS

- First check what you need: more information on a new product or an ad, copies of free catalogs, bulletins
- Then describe the product, or literature desired. Give model numbers, bulletin numbers wherever you can
- Be sure to write in number of page on which item appeared, and issue of POWER in which you spotted it
- Finally, address reverse side of card to the manufacturer concerned

If you like this quick, direct-to-manufacturer service, we'll gladly send you a supply of cards

PLACE 2¢ STAMP HERE

Reader Service Department
POWER
330 West 42nd Street
New York 36, N. Y.

I want details on these New Products... 8/53

☐ ☐ ☐ ☐ ☐ ☐

Send me these FREE Catalogs and Bulletins...

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My Name.....
Please print
Title.....
Company.....
Street Address.....
City, State.....

Please use before December 1, 1953. Void after this date.

GENTLEMEN: Please send me, without obligation, further information on the following: *(Check one and describe)*

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I want details on these New Products... 8/53

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City, State

GENTLEMEN: Please send me, without obligation, further information on the following: *(Check one and describe)*

☐ NEW PRODUCT ☐ ADVERTISEMENT ☐ LITERATURE

_____
Describe item here

_____

It appeared on page_____of the_____Issue of POWER.

My Name .....
Please print

Title .....

Company .....

Street Address .....

City, State .....

This month's
FREE Literature

AIR CONDITIONING

1 **Home air-conditioning** treated as year-round operation in 8-page, illustrated pamphlet, *Glazing the Air-Conditioned Home.* Sketches and data on transmission of solar energy through various types of glazing. LOF Form 23. Libbey-Owens-Ford Glass Co, Toledo 3, Ohio.

2 **Centrifugal fan type** unit heaters described in 16-page catalog. Photos, spec charts and tables, applications and optional features of *Airtherm* line shown. Catalog 403. Airtherm Mfg Co, 780 S Spring Ave, St Louis 10, Mo.

3 **Pneumatic** spreader stokers for bituminous, sub-bituminous, high ash-fusion and lignite coals described in 12-page catalog. Text covers coal conveying, drying and preheating, automatic firing. Material on automatic combustion controls, dumping grates, fly-ash reinjection system. Form 2530. Iron Fireman Mfg Co, Cleveland 11, Ohio.

ELECTRICAL AND MECHANICAL CONTROLS

4 **Instrumentation Index** presents more than 300 technical case histories and general information articles covering automatic control applications in all major industries. Minneapolis-Honeywell Regulator Co, Sta 64, Wayne and Windrim Ave, Philadelphia 44, Pa.

5 **Safety alarms** and cut-outs for temperatures up to 1800 F covered in illustrated leaflet. Mounting methods, operation, and specs of models H-1S and V-1W included. Bulletin 101. Burlington Instr Co, South Orange, N. J.

6 **Direct-measuring pyrometric** controls featuring "straight-line" *Capacitrol* model 252P described in two bulletins. On-off, proportioning, multipoint control systems discussed. Bulletins PC-2 and CL-1. Wheelco Instruments Div, Barber-Colman Co, Rockford, Ill.

7 **Control instruments** for furnaces, ovens, dryers, kilns covered in illustrated catalog. Diagrams, specs, price lists included. Catalog P1255. Bristol Co, Waterbury 20, Conn.

8 **Across-the-line** motor starters, sizes 0-3, described in 8-page bulletin. Covers manual, magnetic, combination and reversing starters as well as push button control stations. Illustrated bulletin 14B7132A. Allis-Chalmers Mfg. Co, 952 S 70th St, Milwaukee, Wis.

9 **Vacuum switch** designed to shut off electric and gasoline motor driven pumps and similar equipment operating on limited liquid source or vacuum. 2-page folder with cutaways, diagrams, specs. Forms 35 and 36. Jaycon Associates, 404 N Washington Ave, Minneapolis 1, Minn.

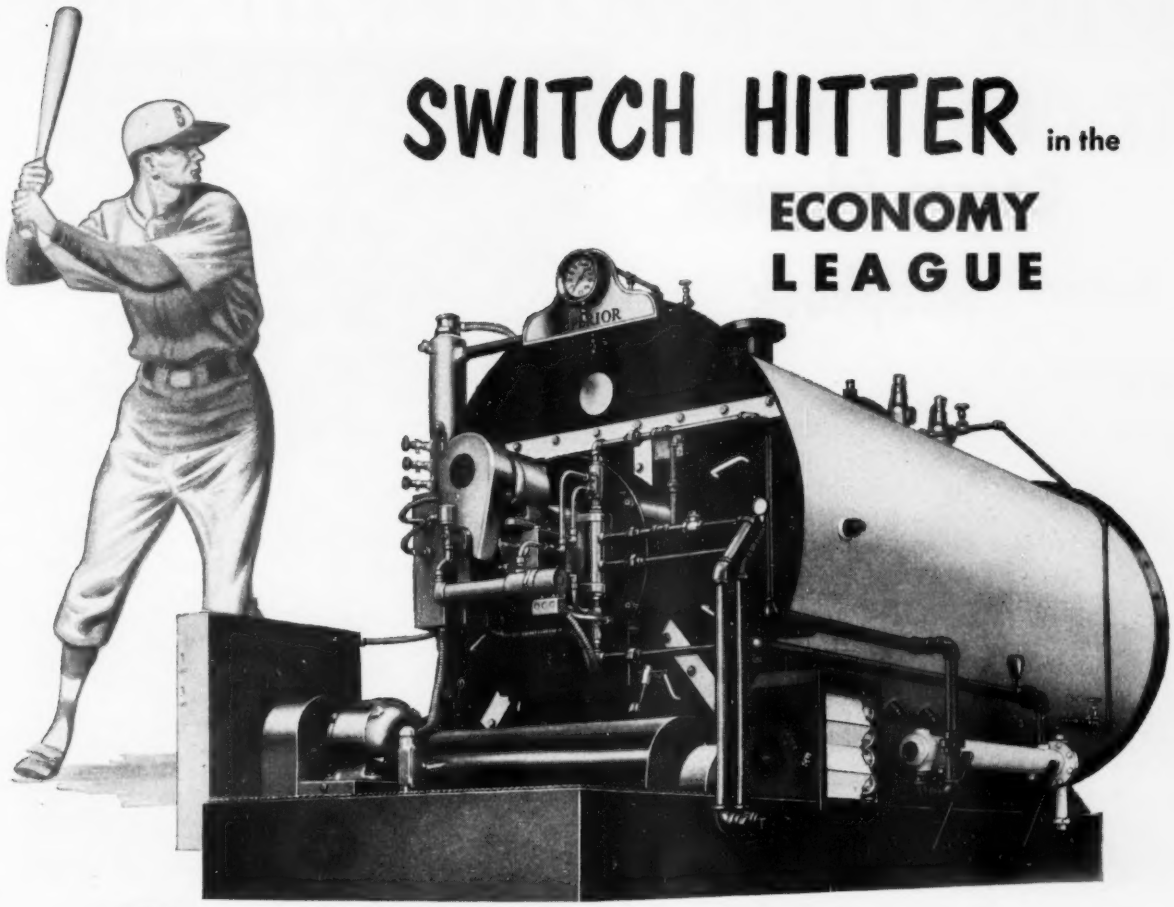
10 **Injection mold** temperature control discussed in 6-page bulletin. Covers effects of temperature and speed in molding of thermoplastics. Photos, spec tables, diagrams. Tech bulletin 7. Sarco Co, Inc, Empire State Bldg, New York 1, N. Y.

11 **Metering and control** equipment presented in 15-page catalog. Basic specs, photos, diagrams and references tell how to select proper metering and control equipment. Bulletin 18. Bailey Meter Co, 1050 Ivanhoe Rd, Cleveland 10, Ohio.

12 **Proportional mixer** with adjustable jet handles varying burner requirements with a simple field adjustment. Can be used with any burner capacity in its range and with all commercial gases. Bulletin L-700, 2 pages with photos, diagrams, cap ranges, specs. Eclipse Fuel Engineering Co, Rockford, Ill.

13 **Potentiometer Signaling-type** pyrometer controller described in 3-page folder. Data on applications, accuracy, standard scale ranges. Photos, diagrams, specs. Catalog section 50. Thermo Electric Co, Inc, Fair Lawn, N. J.

(Continued on page 230)



SWITCH HITTER in the ECONOMY LEAGUE

SUPERIOR
STEAM GENERATORS

Just as the switch hitter changes his batting stance to take full advantage of the pitching situation, Superior Steam Generators change fuels to take advantage of the price situation. When equipped with combination gas/oil burners, Superior Steam Generators switch from one fuel to the other quickly, and without dismantling the equipment or interrupting the steam supply.

Superior Steam Generators are completely factory-assembled and fully tested prior to shipment for guaranteed performance exceeding 80% thermal efficiency, fully automatic . . . burning oil or gas . . . and are available in 18 sizes from 20 to 600 b.h.p. for pressures to 250 p.s.i. or for hot water. For complete details write for catalog 500-F.

for performance you can **BANK** *on*

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

SUPERIOR
STEAM GENERATORS

George Edwards' Scrapbook

Said H A Winne, VP of Engineering for G E at diamond jubilee of Case Inst of Tech, "In a large power plant, cost of equipment per electrical kilowatt capacity is $75 to $100. Corresponding **atomic pile costs** in 1950 were $10,000. In 1952 estimate for first nuclear-powered submarine was $1,400. Figures for land-type plants might be lower, around $500 to $600. This is above $100 goal, but encouraging part is cost is dropping so rapidly."

' ' '

Here's a classified ad from a Virginia newspaper that reader John Gorrie sends in:

Wanted, Engineer—first class
No experience required.

As you might expect, Mr Gorrie is upset because he holds both American and British licenses. They took plenty of experience and even some book learning. Now he wonders if the effort has been worth while. What do you readers think?

' ' '

Success or failure in business is caused more by mental attitude even than by mental capacities.

—WALTER DILL SCOTT

' ' '

Recently I heard W S Pellini, of National Research Lab, Washington, D. C., give a talk at Notre Dame in South Bend. He talked on **welding failures.** "Of 5000 welded ships built during the war, about 1000 had fractures of some kind. And of these, about 200 developed major cracks. This isn't a bad record when we suddenly mass-produce with a radically new technique. Yes, and with Tom, Dick and Harry—and Pauline welding with electrodes."

"I won't argue whether industry does a swell job of welding," mused George Keeler, my consulting engineer friend. "But where's the romance in structural steel work today when you can't watch a guy toss a red-hot rivet up in the air and see another guy perched up on a girder catch it in his bucket."

This old photo from my family album brings back many happy memories. And the model T Ford pictured here has an important lesson for all engineers. From 1909 to 1928 Henry Ford built 15 million of these gas buggies. His mass production methods dropped prices from $900 to only $350 a car. So almost everyone could own a "tin lizzy".

But I still visit plants where mass production methods started by Ford 50 years ago evidently haven't been heard of.

' ' '

"If you can't get along with a few people it may be their fault. If you can't get along with many, it's always your own fault"—PHIL SWAIN, from his "New Proverbs For Young Engineers."

' ' '

When my friend Julian Boone, sales promotion manager of POWER, sent me his new *Industrial Advertising Handbook*, I got some inside information on how well a well-written ad is read as compared with editorial material in the same magazine. Here are results of one **readership survey:**

"In a study by Advertising Research Foundation, ads of US Industrial Chemicals were given a 'read some' rating of 78 percent (nearly double next ranking ad)—more than the most popular editorial feature. Readership of ads has steadily increased—last year they averaged 750 inquiries per insertion."

I've been reading ads in technical magazines all my life and know this firm gives enough technical information to interest the right readers, instead of telling in general terms how "good," or how "efficient," or how "modern," their product is. Wish some ad men would learn that we busy engineers expect to LEARN *something when we read an ad.*

George Edwards

ARE CLOGGED LINES LIKE THESE CUTTING YOUR WATER SUPPLY?

Over 1½ Miles of Buried Water Line Chemically Cleaned IN PLACE by Dowell Service

You don't have to dig up water lines in order to clean them! Take the case of a major railroad that had over 8600 feet of *buried* water lines, ranging from 2 to 12 inches in diameter. The capacity of these lines had been greatly reduced by scale deposits. Dowell Service used liquid solvents to clean all the lines, *in place*, during a period of only six days with a minimum interruption in service.

Dowell Service offers *fast*, effective chemical cleaning of pipelines of all kinds—water lines, disposal lines and product lines. And, whether these lines are underground or above, indoors or out, no digging or dismantling is necessary. Dowell solvents are designed to dissolve the accumulated deposits, and are introduced through regular connections. Because they are liquid, Dowell solvents reach wherever steam or water can flow, cleaning places inaccessible by other methods—angles, curves, valves, complicated surfaces and hook-ups. *Experienced* Dowell engineers do the job using Dowell-designed truck-mounted pumps, mixers and control equipment.

Many other types of equipment can also be cleaned chemically by Dowell. If you have boilers, condensers, evaporators, bubble towers, water wells or other operating equipment where deposits are reducing capacity, let Dowell Service *save you time and money in maintenance cleaning!*

FIND OUT ABOUT CHEMICAL CLEANING! There are many places in your plant where Dowell Service can clean equipment faster and better than out-dated mechanical methods. Call your nearest Dowell office for a fact-filled book. Or write direct to Tulsa, H-23.

DOWELL SERVICE

Over 100 Offices to Serve You with Chemical Cleaning for:

Boilers • Condensers • Heat Exchangers • Cooling Systems
Pipe Lines • Piping Systems • Gas Washers • Process Towers
Process Equipment • Evaporators • Filter Beds • Tanks

Chemical Services for Oil, Gas and Water Wells

DOWELL INCORPORATED
Tulsa 1, Oklahoma

DOWELL

A Service Subsidiary of
THE DOW CHEMICAL COMPANY

Better Valves–Year After Year

Fig. 19003 W. E. 900-pound Cast Steel Pressure Seal Gate Valve with welding ends. Also made for 600, 1500 and 2500 pounds W. S. P.

Because for more than a hundred years Powell Engineers have never been willing to "let well enough alone," the Powell Line of Valves has been continually improved and expanded to satisfy every new demand of Industry.

That is why you'll find a greater variety of Powell Valves in service today than of any other individual make.

Shown here are a few of the many Powell designs for the modern Power Plant.

The Wm. Powell Company
Cincinnati 22, Ohio

DEPENDABLE VALVES SINCE 1846

POWELL

Fig. 559—125-pound Iron Body Bronze Mounted Swing Check Valve. Flanged ends, bolted flanged cap and regrindable, renewable bronze seat and disc.

Fig. 375—200-pound Bronze Gate Valve with screwed ends, union bonnet and renewable wear-resisting "Powellium" nickel-bronze disc.

Fig. 1531 W. E.—150-pound Cast Steel O. S. & Y. Globe Valve. Welding ends.

Fig. 1333-A—1500-pound Steel Integral Bonnet Angle Valve. Socket weld ends.

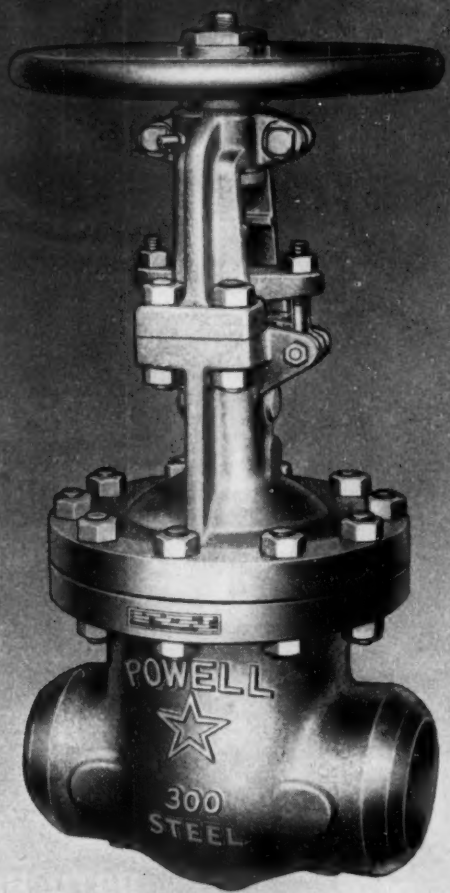


Fig. 3003 W. E.—300-pound Cast Steel Gate Valve with welding ends, bolted flanged yoke, outside screw rising stem and tapered solid wedge.

VALVES

IN BRONZE, IRON, STEEL AND CORROSION-RESISTING METALS AND ALLOYS

PANALARM "50"

OPENS THE DOOR

TO MORE DEPENDABLE ANNUNCIATOR PERFORMANCE

WITH NEW "INSTRUMENT-TYPE" CONSTRUCTION

LOOK inside the new Universal PANALARM "50". You will realize that here, at last, is an annunciator system built for *long term* dependability and service. Built to match the responsibility an annunciator must assume in your plant.

The PANALARM "50" Cabinet has a substantial hinged door . . . with sub-door to allow easy access to signal lamps. It has a new, rugged chassis design . . . pre-wired to handle any standard audio-visual signal requirement . . . and so flexible that signal sequences can be changed by simple terminal connections. No re-wiring is needed.

All moving parts and contacts of the PANALARM "50" are within hermetically sealed, plug-in units. They are corrosion-proof and suitable for Class I, Div. 2 locations. All connections are made to a single terminal block . . . with ample space for wiring.

SEND FOR COMPLETE 40-PAGE MANUAL

Ask for Catalog 100-1

PANALARM

PANALARM PRODUCTS, INC.

6312 North Broadway, Chicago 40, Illinois

Copyright 1953—Panalarm Products, Inc

More EQUIPMENT NEWS

Begins on page 154

Tubular Scaffold

848 • New *Hardie* clamp scaffolding can be erected quickly and easily by two men. Patented hub spiders lock two inch pipes together. Scaffold can be used in any position, with same members adding to height or width as required.

George C Hardie, 519 Atlantic Ave, Brooklyn 17, N. Y.

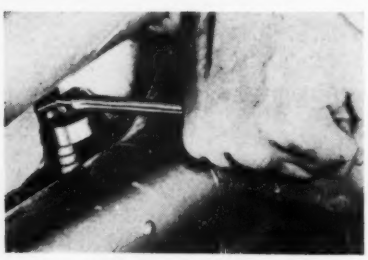
Ventilating Hose

820 • *Portovent* flexible hose for fume exhaust and ventilation has unusual lengthwise compressibility, and will maintain a large cross section even on sharp bends.

The hose is made from cotton or nylon fabrics, impregnated with Neoprene and spiral wire reinforced. Available from 4 to 36 in. inside diameter, in any length.

American Ventilating Hose Co, 100 Park Ave, New York 17, N.Y.

For more data on these items, use post cards p. 163. Identify your request with item number.



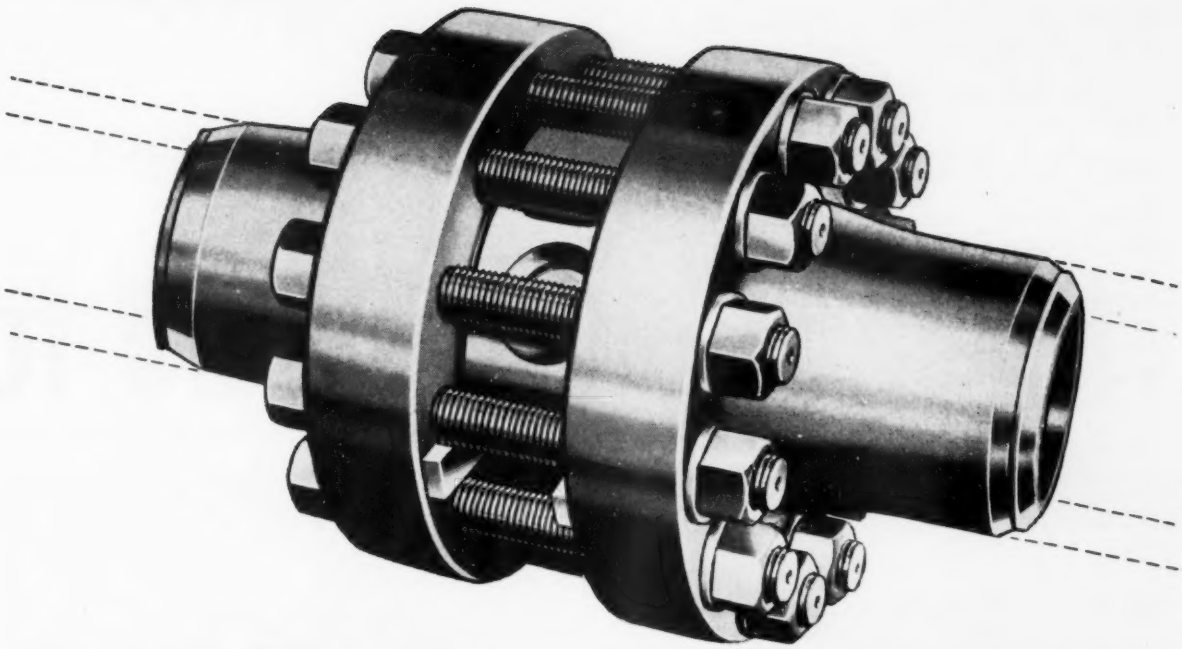
Ratchet Wrench

833 • Open-end socket-type ratchet wrench fits over and around cables, wiring, tubing and piping to tighten hex nuts and fittings. The tool functions with as little as 7 degrees ratcheting arc, manufacturer claims. Head and sockets are centerless.

Available in six sets with a total of 64 snap-in sockets, covering range from ⅜ to 4 in. diameter.

Tubing Appliance Co, 10321 Anza Ave, Los Angeles 45, Calif.

(*Continued on page* 174)

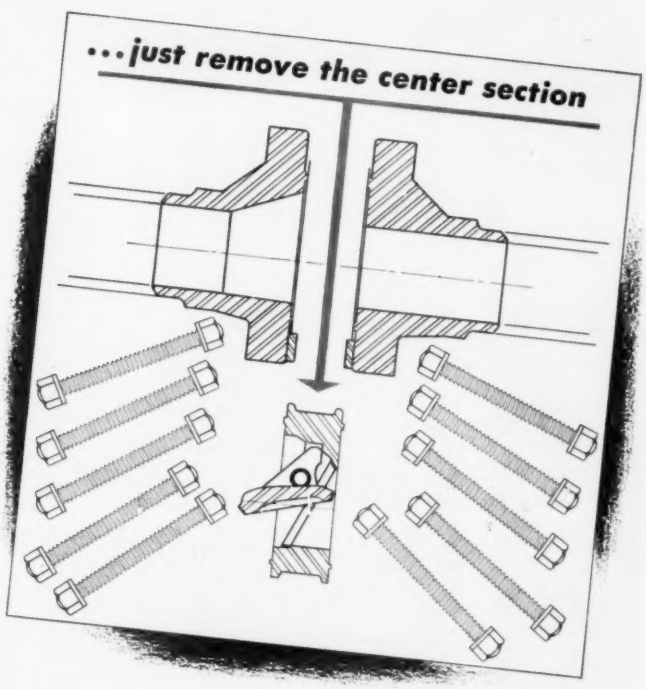


NO NEED to cut this valve out of a Welded Line

...it's a CHAPMAN 3-PIECE TILTING DISC CHECK VALVE

Remove studs between inlet and outlet ends. Then the whole center section can be slipped out *as a unit* . . . and quickly and easily replaced. Figure the savings for yourself!

Here, Chapman design gives you the smooth operation and quiet closing of the 2-piece Tilting Disc Check Valve . . . with the unique advantage of practically immediate interchangeability of "the works." And *only* Chapman makes this complete line of Tilting Disc Check Valves. Send for your Chapman "Check Book" — *now!*



The Chapman Valve Mfg. Co.
INDIAN ORCHARD, MASSACHUSETTS

On these pages are five examples of the variety of heavy-metal equipment designed and built by Alco to solve scores of new industrial problems. Each was made possible by two important factors.

First: Alco is thoroughly familiar with industry's needs. Its designers and engineers have worked closely for many years with power, petroleum, chemical and manufacturing companies in all parts of the world.

Second: Alco has the complete production and testing facilities required to handle efficiently and economically nearly every type of metal fabricating operation.

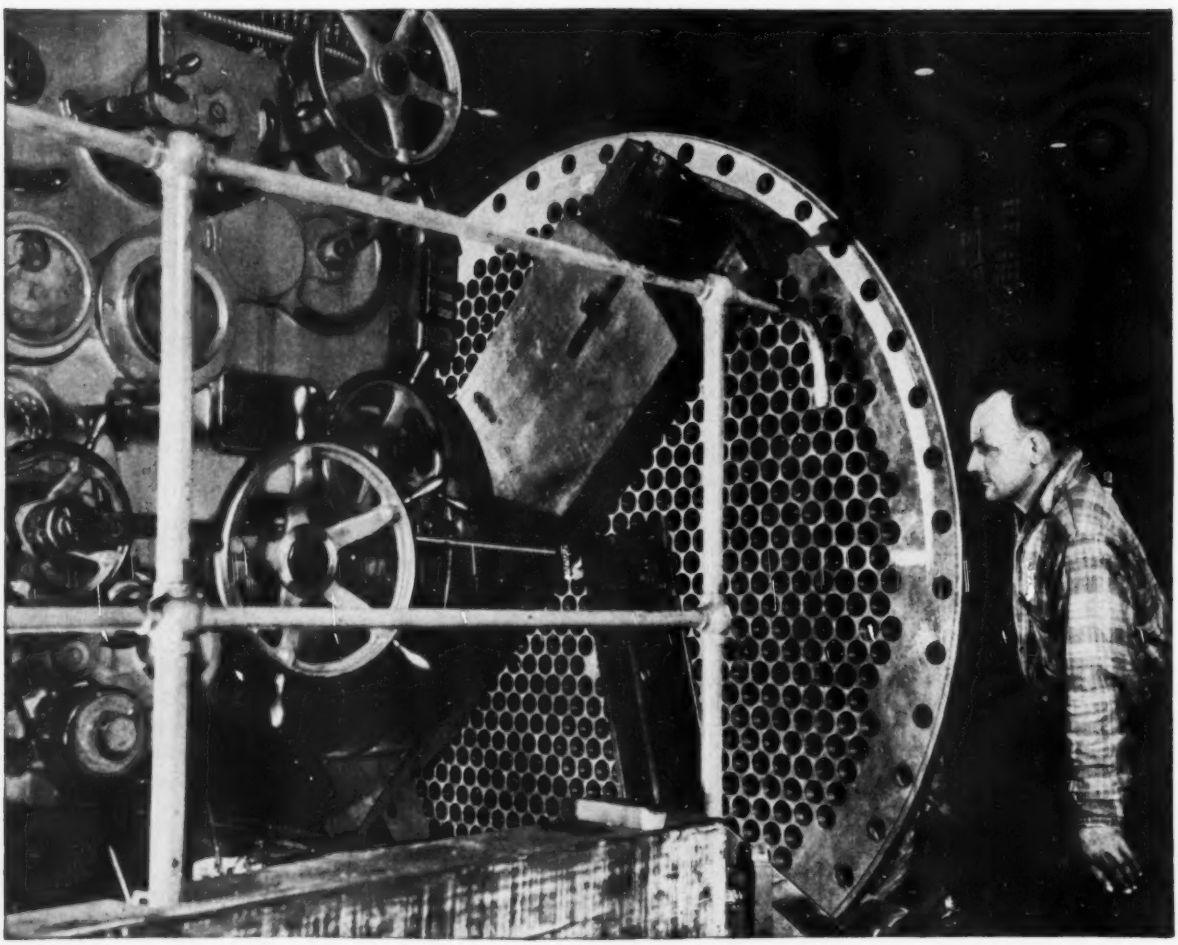
Remember these factors next time you have a problem that calls for something extra in heavy-metal equipment. Then contact your nearest Alco Products Sales Engineer at New York, Chicago, Los Angeles, Kansas City, Houston, Tulsa or Beaumont; or write direct to Dunkirk, N. Y.

How ALCO designs

Answers to

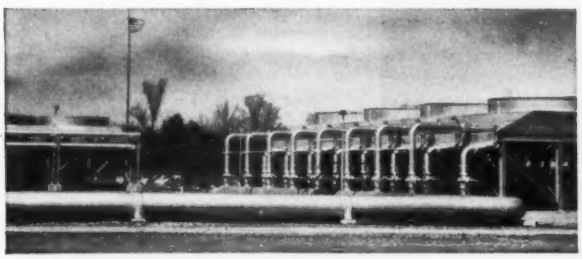
Alco

COMPLETE PRODUCTION FACILITIES, backed by years of experience, enable Alco to fabricate all types of heavy-duty power and processing equipment to meet virtually any specifications. Shown here is a specially designed flange-facing machine in operation at Alco's 31-acre Dunkirk plant.



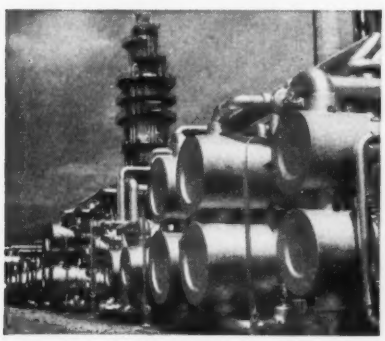
and builds...

New Industrial Problems

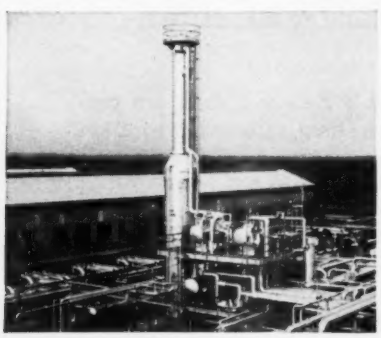


ALCO AIRCOOLERS—the economical answer to a wide range of cooling problems—handle a major part of the heat dissipation at Transcontinental Gas Pipeline Company's modern compressor station at Spartansburg, S. C. Transco also installed these versatile Alco units at their stations near Comer, Ga., and Reidsville, N.C.

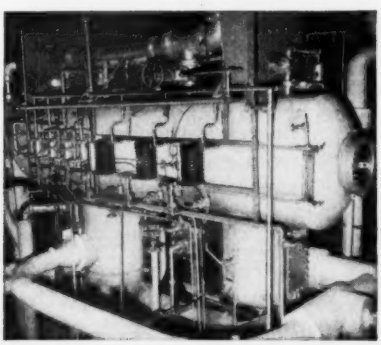
ALCO ELECTRIC WELDED STEEL PIPE, available in diameters up to 120 in., is now giving low-cost, high-capacity service in water, gas, oil and sewer installations throughout the country. Furnished in sizes limited only by shipping considerations, Alco pipe helps cut installation time to an absolute minimum.



CUSTOM-BUILT HEAT EXCHANGERS were among the variety of Alco equipment specified for Esso Petroleum Company Limited's giant new refinery at Fawley, England. The largest refinery in Europe, Fawley produces fuels, solvents, lubricating oils and other products at the rate of over 6,000,000 tons a year.



DE-ETHANIZER TOWER was built by Alco to meet the strict requirements of Tennessee Gas Transmission Company's new gas processing plant at Gabe, Kentucky. Years of experience and the most modern manufacturing facilities enable Alco to produce heavy-metal equipment for nearly every purpose.



FLEX-TUBE EVAPORATORS at Florida Power Corporation's Bayboro plant at St. Petersburg, Florida, produce 7000 pounds per hour of vapor with a guaranteed purity of 0.9 ppm, based on 2480 ppm shell concentrate. Removal of scale on tube surfaces is greatly facilitated by Alco's patented Flex-Tube construction.

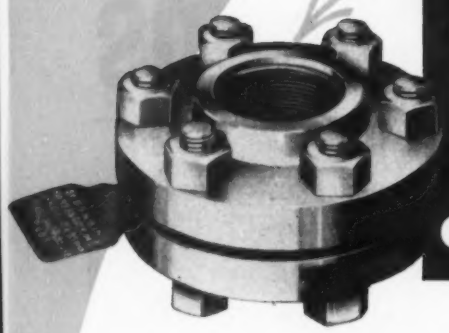
ALCO

ALCO PRODUCTS DIVISION

AMERICAN LOCOMOTIVE COMPANY • DUNKIRK, NEW YORK

QUESTION:

When does weakness mean safety?



ANSWER:

Only When It's In BS&B *Safety Heads*

Safe, Sure Protection Against Overpressure within Pressure Vessels

Sudden Pressure, Safe Relief—that's what BS&B Safety Heads are designed to give. There's no damage to equipment, no danger to employees. BS&B Safety Heads fail within plus or minus 5% of the pressure specifications *you* give us, whether 5 lbs., 40,000 lbs., or anywhere in between.

Tested to Destruction, BS&B Safety Heads are pre-proved at the factory. Rupture Discs, selected at random from each lot, are put under pressure until they fail. If each one tested does not break within 5% of the rated pressure, the entire lot is discarded!

A Full, Pipe-Sized Opening results when a BS&B Safety Head Rupture Disc blows out. You can use them for primary or secondary relief where maximum protection is needed, or to back up a relief valve when the contents might prevent the valve from functioning properly. Whether *your* pressure applications are for air, gas or liquids—bland or corrosive—you can count on BS&B Safety Heads for safe, certain relief.

See our exhibit at the Eighth National Instrument Exhibit, Sept. 21 to 25, Sherman Hotel, Chicago Booth 148 to 150

Write for Complete Catalog

Whatever your pressure applications, there's a BS&B Safety Head for you. Write today for the Safety Head Catalog, or ask your BS&B Man. There's no cost or obligation for a complete analysis of your pressure safety requirements.

SAFETY BS&B HEADS OUR 50TH YEAR

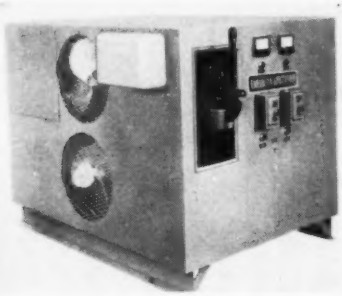
BLACK, SIVALLS & BRYSON, INC.

Safety Head Division, Dept. 2-Q8

7500 East 12th Street Kansas City 26, Missouri

More EQUIPMENT NEWS

Begins on page 154



Standard Unit Rectifiers

822 • Unit rectifiers from 3 to 50 kw, 125 or 230 v, dc, output and either fixed or variable voltage, dc units to accommodate any ac voltage or frequency input are available in stock, manufacturer states. Also available upon request are standard input voltages at 60 cycles. Bulletin sent on request.

American Rectifier Corp, 95 Lafayette St, New York, N.Y.

Indicating Controller

849 • Model 221C *Capacitrol* features anticipating action to give "straight-line" control. The unit anticipates, through a resistor network and relay circuit, the approach and departure of temperatures caused by various heat transfer lags and load requirements.

Manufacturer also offers four additional model 200 series *Capacitrols*, two for regular on-off control and two for proportioning control.

All models use an "electronic link" to provide accurate control with no contact between measuring and control systems. Sensing element may be a thermocouple or resistance bulb. Bulletin F 5783.

Wheelco Instruments Div, Barber-Colman Co, Rockford, Ill.

For more data on these items, use post cards p. 163. Identify your request with item number.

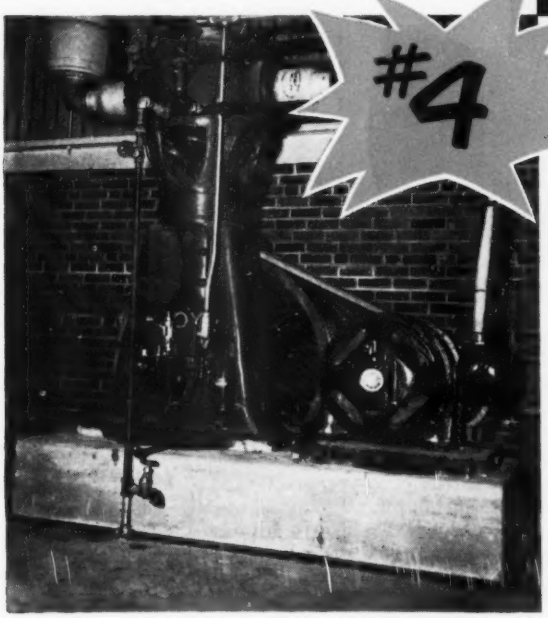
Sample Cooling Coil

850 • Model SC-7A B-W coil consists of Cupre-nickel concentric coiled tubing, stainless steel connecting blocks, dial thermometer and mounting bracket. Unit allows checking high pressure steam or boiler

...They've added their FOURTH JOY WG-9 COMPRESSOR

Certain-teed's new Oklahoma paper mill uses compressed air in the manufacture of gypsum board papers. In addition, compressed air is used in general shop service, and it also furnishes the pressure for the ever-so-important automatic sprinkler system.

With such dependence upon air supply—24 hours a day—Certain-teed's engineers "bet on the Champ" and, for the fourth time in a row, specified a Joy WG-9 vertical compressor.



The WG-9 is a water-cooled, double-acting, single-stage compressor built to deliver medium amounts of air *constantly*. It, alone in its class, offers replaceable crosshead guides and cylinder liners, force-feed lubrication, and bearings that *never* need adjusting. As an extra bonus, "Dual-Cushion" valves are included to give higher valve capacity and better heat dissipation.

All-in-all, the WG-9 is a potent performer—able to take the measure of any compressor in its class. Get the specifications and check the record . . . you'll be convinced, too. Bulletin A-43 gives all data and will be sent upon request. ● ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

15 SIZES • 30 to 150 PSI • 172 to 881 CFM

FOR OIL-FREE OPERATIONS WE OFFER THE WGO-9 SERIES

Consult a Joy Engineer

for Vaneaxial Fans . . . Compressors, Vacuum Pumps and Boosters . . . Oxygen Generators

WBD 1 4645

JOY

SPECIALISTS IN THE COMPRESSION AND MOVEMENT OF AIR AND GASES SINCE 1885

Take a good look at this critical PACKING INSTALLATION...

Style 805-MBF Used On This 10-Stage High Pressure Boiler Feed Pump

This set of packings is going to handle a tough job. The pump is rated at 965 gpm, 4250′ total head, handling *hot* (312°F.) boiler feed water at 89# suction pressure and driven by a 3850 rpm induction motor (shaft sleeves are chrome plated—675 Brinell).

There are many styles of "John Crane" Packings—but Style 805-MBF was recommended and used because it was developed *and developed alone* for high speed centrifugal boiler feed pumps. The natural lubricating characteristics in the design of the monel and asbestos yarn braid-over-braid construction makes it a strong, wear resistant packing. Used in hundreds of installations all over the world—it has proved to be a highly efficient, long-life, trouble-free packing that gives you the results you want.

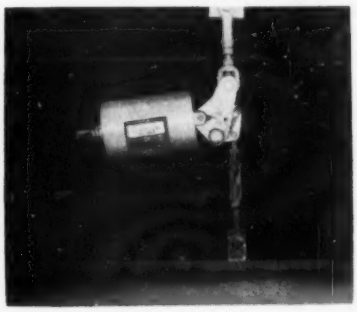
For quick action, let our Engineering Department help you. Write for latest "John Crane" Packings Catalog. Crane Packing Company, 1830 Cuyler Avenue, Chicago 13, Illinois.

JOHN CRANE CRANE PACKING COMPANY

More EQUIPMENT NEWS

Begins on page 154

water by a standard conductivity cell. Sample to be tested is reduced in temperature and pressure to required measuring range. **Industrial Instruments, Inc, 89 Commerce Rd, Cedar Grove, N. J.**



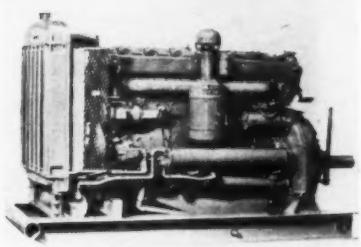
Pipe Hanger

831 • *Navco* counterpoise pipe hanger is designed especially for high-temperature piping systems. Spring-actuated counterbalance transforms varying force of the spring to produce a load supporting effort of constant value throughout the entire range of pipe travel.

Flexible top connection permits the hanger assembly to fall in line with the direction of load pull so horizontal travel of piping has no appreciable effect on hanger operation. Unit may be positioned at any angle.

Available in 16 sizes with load capacity from 200 to 16,000 lb, expansion travels up to 12 in. Bulletin 153.
National Valve & Mfg Co, 3114 Liberty Ave, Pittsburgh 1, Pa.

For more data on these items, use post cards p. 163. Identify your request with item number.



Diesel Engines

819 • Manufacturer's line of diesel engines is increased with addition of four new 6⅜ x 6½ in. models. Continuous ratings of the new units are as follows: No. 24, 185 hp; No. 124, 210 hp; No. 224, 200 hp; No. 324, 225 hp. Models 24 and 124 operate at 1200 rpm; 224 and 324 at 1400 rpm.
Murphy Diesel Co, 5317 W Burnham St, Milwaukee 14, Wis.

Steel Framing System

851 • *Flexa* system of all-bolted steel framing for construction and maintenance work includes concrete inserts, pipe rollers and hangers, clamps and other fittings. Applications include tunnel framing, hang-

...with TYCOL lubricants on hand!

It pays to buy a "Diesel-Designed" Lubricant! ... It takes "something more than a motor oil" to counteract excessive wear in Diesel engines – and we proved it with Tycol Adeltran 40! In this instance, a Diesel engine was operated for one year with a competitive oil. An overhaul by the manufacturer turned up these conditions: all liners had to be replaced as well as piston rings ... 2 top compression rings were stuck and all rings were gummed up. After the switch to Adeltran (for the same operating period) liner wear was negligible ... filter life was considerably extended ... all rings were free and in excellent condition ... and owner reported an exceptionally clean engine base. For full details on Adeltran, contact your local Tide Water Associated office!

TYCOL
INDUSTRIAL LUBRICANTS

Boston • Charlotte, N. C. • Pittsburgh
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TIDE WATER ASSOCIATED OIL COMPANY
17 BATTERY PLACE · NEW YORK 4, N. Y.

Over 300 Tycol industrial lubricants are at your disposal ... engineered to fit the job!

REFINERS AND MARKETERS OF VEEDOL ... THE WORLD'S MOST FAMOUS MOTOR OIL

ROTOJET®
TUBE CLEANERS

Give More Power
Use Less Air

More power with less air for a faster, more thorough tube cleaning job—that's what the new Rotojet offers. A Rotojet should save you enough in time, labor, and air on one cleanout to pay for itself. Send for Bulletin R-105 for full details.

THE SECRET

ROTOJET Motor has only two moving parts, a shaft and a paddle. Positive contact between paddle and Rotocentric (egg-shape) bore cylinder prevents stalling at low speeds. No leakage. Delivers maximum power for air used.

ELLIOTT COMPANY-ROTO DIVISION
153 Sussex Avenue Newark 1, N. J.

More EQUIPMENT NEWS

Begins on page 154

ing fluorescent lighting fixtures and other electrical equipment, and general support and racking in the heating, plumbing and air conditioning field.

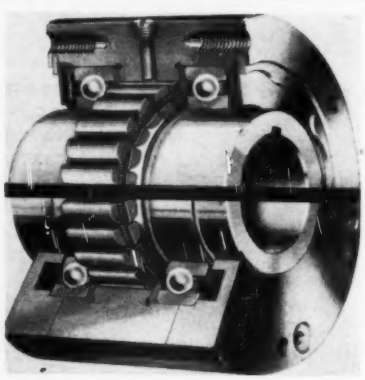
Flexa Steel Products, Inc, 1348-50 W Washington Blvd, Chicago 7, Ill.

Voltage Tester

810 • *Super safe* tester will show nominal line voltages from 110 to 550 ac, and 110 to 600 dc, as well as distinguish between ac and dc and show polarity of dc lines, manufacturer claims. Unit is enclosed in a one-piece plastic case.

Solenoid calibrated indicator and neon test lamp operate independently, so that one will detect voltage even if the other fails. **Ideal Industries, Inc, 1025 Park Ave, Sycamore, Ill.**

For more data on these items, use post cards p. 163. Identify your request with item number.

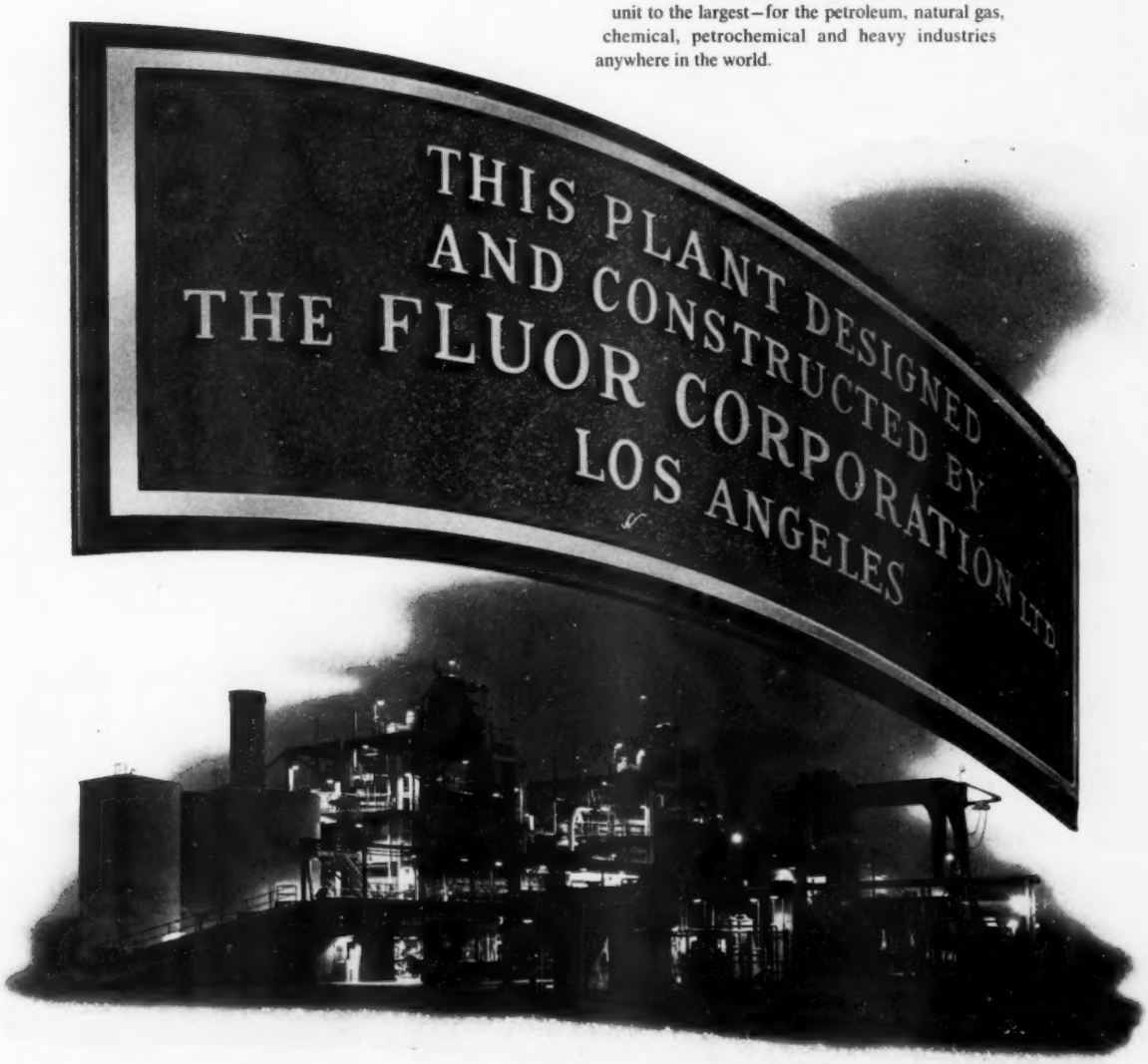


Over-Running Clutch

852 • New sprag-type clutch with centrifugal throwout sprag assembly rubbing between the sprags and the inner race, can

HIGHGROVE, CALIFORNIA. California Electric Power Company's new, modern 60,000 KW steam-electric generating plant now in commercial operation here was designed, engineered and constructed by The Fluor Corporation, Ltd. Many design innovations make this plant one of the most unique in existence. Except for the control rooms and switch gear the plant is completely outdoors and was planned for operation with an absolute minimum of attending personnel. The entire job was completed in advance of the originally scheduled operating date notwithstanding the extreme difficulty of obtaining some items of material and equipment. Additional units are being added to bring the total output to 140,000 KW.

Fluor's ability to build efficient power plants has been ably demonstrated many times and is recorded in the illustrated brochure, "The Highgrove Story." Copies are available upon request. Fluor's broad experience also extends into the design and construction of all types of facilities—from the smallest unit to the largest—for the petroleum, natural gas, chemical, petrochemical and heavy industries anywhere in the world.



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THE FLUOR CORPORATION, LTD.
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Weber's

H.T. BLOCK INSULATION

You can pour castable refractories directly against

WEBER'S H. T. BLOCK
without waterproofing the block surface!

And that's not all; Weber's H. T. Block is:

- Resilient—for less field breakage.
- Square cut—for an easy fit and a tight fit.
- Chemically inert—for protection of insulated metal surfaces.
- Single block insulation—for temperatures from −250° F. to 1800° F.
- No special tools—for faster on-the-job application.

ASK FOR BULLETIN 501 . . . WRITE TODAY

FORTY-EIGHT INSULATIONS, INC.
AURORA, ILLINOIS

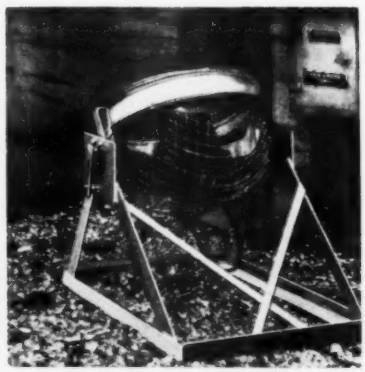
More EQUIPMENT NEWS

Begins on page 154

operate at speeds exceeding 3000 rpm.

Unit consists of four basic parts: outer housing, inner race, sprags, energizing springs. Manufacturer claims backlash is eliminated, maximum torque capacity is assured.

Formsprag Clutches, 23601 Hoover Rd, Van Dyke, Mich.

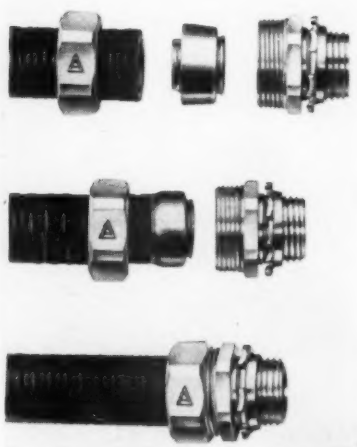


Weather-Proof Fans

832 • New line of weather-proof fans is designed for transformer cooling and other outdoor applications where the fan must operate unattended. Available with blade sizes of 16, 20, 24, and 30 in., with certified air delivery ratings from 2820 to 6710 cfm.

Propellair Div, Robbins & Myers, Inc, Springfield 99, Ohio

For more data on these items, use post cards p. 163. Identify your request with item number.



Liquid-Tight Connectors

853 • New connections are UL approved for protecting electrical conductors on machinery where liquid-tight flexible conduit is used, and are recommended for use with liquid-tight flexible raceway.

All-metal flaring ferrule joins securely with flexible conduit under the compressing action of the tightening nut. ST series connectors exclude oil, water, acid fumes, dirt,

(*Continued on page* 184)

Engineered FOR ACCURATE FIT-UP

THIS TUBE-TURN Welding Return is engineered for shape, size and wall thickness to simplify piping installation. It is forged by the only process that produces a wall as uniform in thickness and true in circularity as the original seamless pipe. This assures accurate fit-up and perfect alignment . . . whether it is used as a full 180° return or cut to any odd angle.

When you specify TUBE-TURN Welding Fittings and Flanges, you are *sure* of getting the ultimate in piping simplicity, safety and permanently leakproof construction. Your nearby TUBE TURNS' Distributor is at your service!

The Leading Manufacturer of Welding Fittings and Flanges

TUBE TURNS, INC. LOUISVILLE 1, KENTUCKY

DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Chicago • Houston • Tulsa • San Francisco • Los Angeles • Denver • Atlanta

Subsidiaries: TUBE TURNS OF CANADA LIMITED, CHATHAM, ONTARIO • PENNSYLVANIA FORGE CORPORATION, PHILADELPHIA, PA.

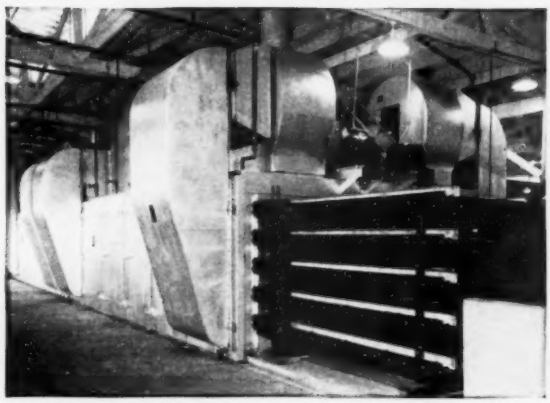
HERE'S SERVICE

TUBE TURNS' *Engineering Service*
HELPS IMPROVE A DRYER DESIGN

C. B. McLaughlin, manager of TUBE TURNS' Engineering Service Division has been working with designers and piping men in the field for years. He and his men are at your service.

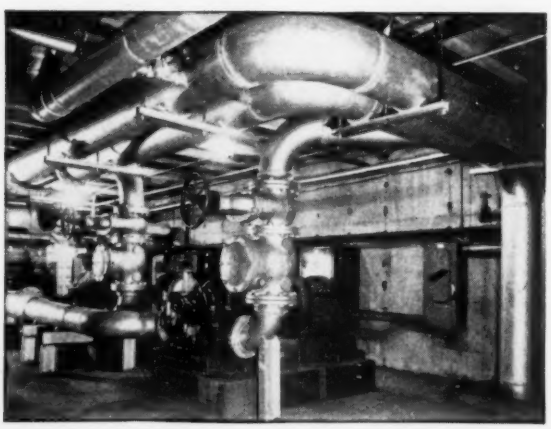
WHERE PIPING is a component of plant equipment, more and more designers are using TUBE-TURN Welding Fittings for directional changes. Results: greater design flexibility, reduced maintenance, less weight and space, improved operation. An example is the veneer dryer shown . . . a product of Coe Manufacturing Company, Painesville, Ohio. Progressive engineers of Coe, with the help of TUBE TURNS' Engineering Service Division, converted the heater from screwed connections to welded construction. Each of its banks of 1-inch pipes is joined by 180° TUBE-TURN Welding Returns. The coils carry steam at 200 psi pressure and 388°F. Joints are now permanently leakproof.

TUBE TURNS' Engineering Service is available to help in *your* piping problems.



Coe Veneer Dryer. Welded coils with TUBE-TURN Welding Returns are compact and permanently tight.

YOUR DISTRIBUTOR of TUBE-TURN Welding Fittings and Flanges can serve you promptly. He is backed up by the entire TUBE TURNS' organization.



COMPACT. Welded piping nests together . . . saves space. These condenser lines are for air conditioning system at Lazarus Department Store, Columbus, Ohio.

Want Materials Data?

Tube Turns, Inc. has prepared a booklet listing properties and specifications of pipe and fitting materials—carbon steels and wrought iron; stainless steels; nickel and nickel alloys; etc. For a free copy just send this coupon.

TUBE TURNS, INC., Dept. C-8
224 East Broadway • Louisville 1, Kentucky

Your name .....

Position .....

Company .....

Nature of business .....

Address .....

City ..... *State* .....

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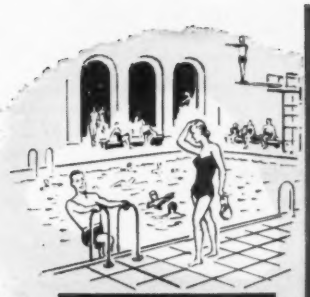
"tt" and "TUBE-TURN" Reg. U. S. Pat. Off.

TUBE TURNS, INC.
LOUISVILLE 1, KENTUCKY



SWIMMING POOLS

DISHWASHERS

SHOWERS

Fast, Dependable Action from ADSCO WATER HEATERS

SPACE HEATING

WASH ROOMS

LAUNDRIES

Hot water! Plenty of hot water! When and where you want it... and at low cost! ADSCO Water Heaters are dependable sources of hot water in any type of plant or building wherever there is a steam supply. Use ADSCO Water Heaters for space heating, for process hot water, or for such general service as showers, laundries, dishwashers, swimming pools...even for snow melting. Write today for Bulletin 35-77 on Convertors, or Bulletin 35-78 on Instantaneous Heaters.

Where storage heaters are needed, write for ADSCO Bulletin 35-75.

ADSCO ENGINEERED PRODUCTS

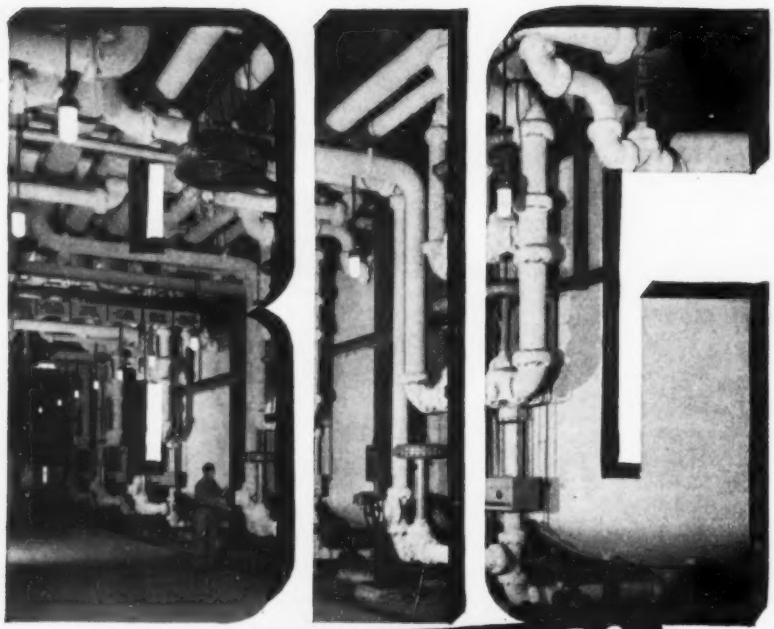
AMERICAN DISTRICT STEAM COMPANY, INC.

NORTH TONAWANDA, NEW YORK

Since 1877

FOR THE DISTRIBUTION AND UTILIZATION OF STEAM, LIQUIDS AND GASES

EXPANSION JOINTS · SEPARATORS · METERS · STEAM TRAPS · STORAGE HEATERS · STRAINERS



DEMINERALIZERS

USE

Nalcite® ION EXCHANGE RESINS

(DOWEX*)

THIS demineralizer, one of the world's largest, provides 100% makeup for 1250 psi boilers generating 1,200,000 pounds of steam per hour. Using Nalco ion exchange resins, Nalcite HCR® and Nalcite SAR, silica is successfully removed from the feedwater — as illustrated by the fact that after 75 to 100 concentrations, silica content of the boiler water is still *less than 5 ppm!*

In demineralizers large or small, Nalcite ion exchange resins give top performance. They are chemically and physically stable for long life at top efficiency. *Two* Nalcite anion exchangers . . . your choice of SAR or SBR . . . are available to meet the conditions of your water supply. Either, used with Nalcite HCR, offers top quality demineralized makeup for high pressure steam generators.

*Reg. Trademark of The Dow Chemical Company.

DATA ON SILICA REMOVAL

A new edition of Nalco Bulletin 57 gives technical data on Nalcite SAR and Nalcite SBR anion exchangers . . . includes complete up-to-the-minute information on silica removal. Write for your copy today.

NATIONAL ALUMINATE CORPORATION

6222 West 66th Place • Chicago 38, Illinois

In Canada: Alchem Limited, Burlington, Ontario

Nalco®

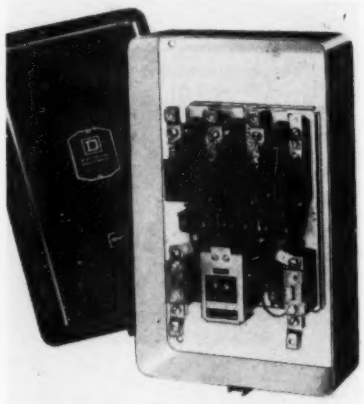
PRODUCTS • *When you use Nalcite resins, you take advantage of Nalco's long and broad experience in water and process technology.*

More EQUIPMENT NEWS

Begins on page 154

grease, etc, and provide a positive ground between conduit and connectors, manufacturer claims. Available in straight, 45 and 90 degree designs, for conduit sizes from ⅜ to 1¼ in.

Appleton Electric Co, 1701-59 Wellington Ave, Chicago, Ill.



Vertical Action Starter

821 • New NEMA size 4 vertical action starter has maximum polyphase ratings of 50 hp 220 v, 100 hp 440-550 v. Overall dimensions are 9¼ in. wide, 14¾ high, 7 3/16 deep.

Contacts are silver, double-break type. Armature has straight-line motion, guided at top and bottom. All parts are front mounted for maximum accessibility, and contacts may be inspected or removed without disturbing line or load wiring. Up to 8 electrical interlocks, 4 normally open, 4 normally closed, may be added to the starter. Magnet has a built-in permanent air gap. Magnetic yokes in each arc chamber increase rupturing capacity well beyond maximum starter rating, manufacturer claims. Bulletin 8536F.

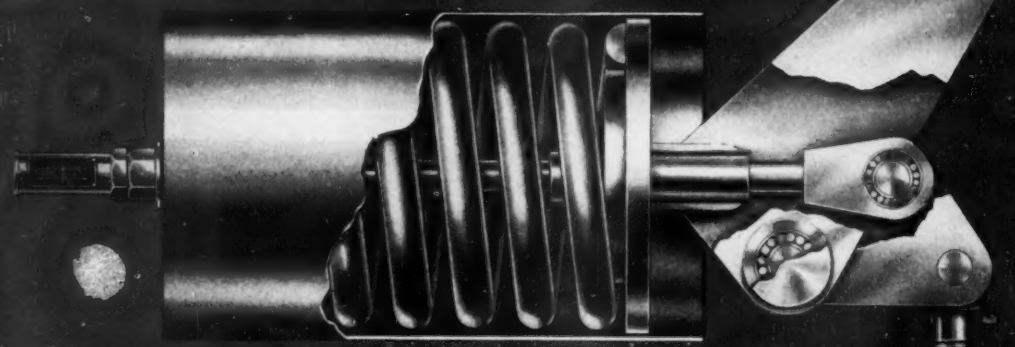
Square D Co, 4041 N Richards St, Milwaukee 12, Wis.

For more data on these items, use post cards p. 163. Identify your request with item number.

Floor Compound

854 • Finely ground cellulose fibre *Cottontex* absorbs more than 8 times its own

You Get Time-Tested Dependability With



NAVCO Counterpoise*

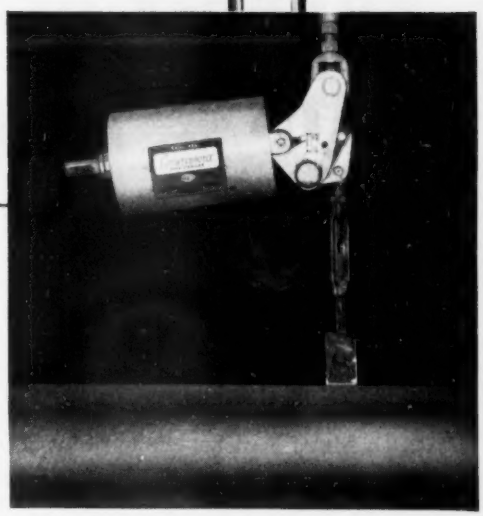
Pipe Hangers

The constant load-carrying capacity of Navco Counterpoise* Pipe Hangers has been proven during an extended period of satisfactory service as the first accurate and efficient support for high temperature piping systems. They are being used extensively in steam generating stations, refineries and chemical plants.

The Counterpoise Hanger is a spring-actuated counterbalance. An ingenious system of linkage transforms the varying force of the spring in an accurate mathematical ratio to produce a load supporting effort of constant value throughout the entire range of expansion travel.

The design permits great flexibility of installation and saves valuable space in congested areas. All parts are ruggedly made and have a high safety factor, yet excess weight and oversize physical dimensions have been avoided to hold space and structural load requirements to a minimum.

The Navco Counterpoise Hanger is available in 16 different frame sizes with load capacities ranging from 200 to 16,000 pounds and expansion travels up to 12 inches. For detailed information on how you can get dependable support with this unique hanger, write today for our 12-page illustrated bulletin #153.



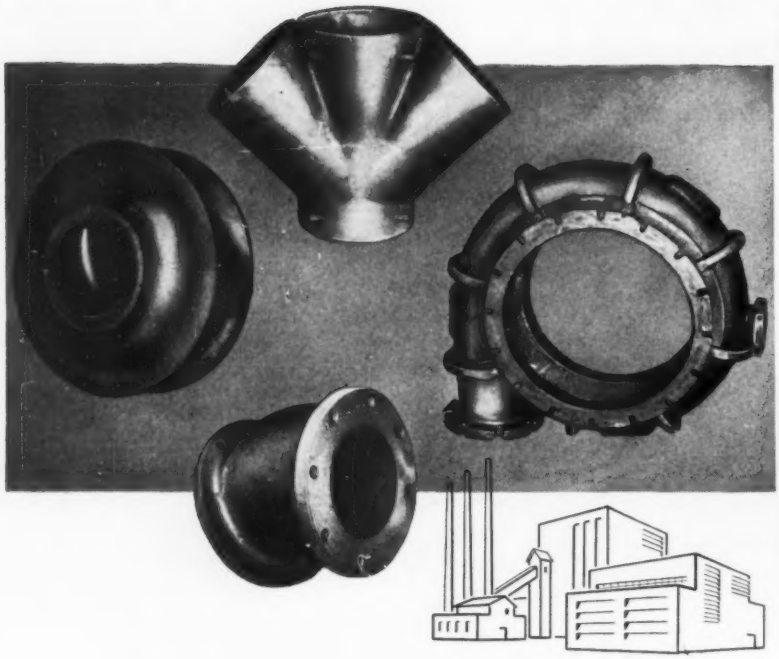
Note above how the flexible top connection permits the hanger assembly to fall in line with the direction of the load pull, so that horizontal travel of the piping has no appreciable effect on the hanger operation. The unit may be positioned at any angle. This affords flexibility in installations where close clearances are a factor.

* *Counterpoise is a trade name of the National Valve & Manufacturing Company*

NATIONAL VALVE & MANUFACTURING COMPANY

3105 LIBERTY AVENUE, PITTSBURGH 1, PENNSYLVANIA

New York • Chicago • Cleveland • Boston • Atlanta • Buffalo • Cincinnati



"ABRASIVE WEAR SHARPLY REDUCED" WITH ABK METAL

For longer service in pump casings, pipes, fittings and other parts subject to abrasion, install castings of ABK Metal. A nickel-chrome iron of controlled structure, ABK Metal is produced only by American Brake Shoe Co.

Time after time, on installation after installation, reports show that ABK Metal is the most economical material for handling ash. The ultimate saving on replacement parts alone is appreciable. The saving in maintenance and shut-downs may be even higher.

Extended life of 4 or 5 to 1 is not unusual when ABK Metal replaces other iron castings—especially in those ash handling or disposal systems where the most severe type of abrasion is encountered. Don't let ABRASION steal your operating dollars . . . SPECIFY ABK METAL.

QUALITY CASTINGS IN | DUCTALLOY | MEEHANITE | ABK METAL

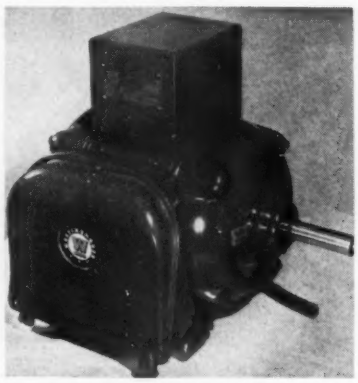
1533 AMERICAN Brake Shoe COMPANY

BRAKE SHOE AND CASTINGS DIVISION
230 Park Avenue, New York 17, N. Y.

More EQUIPMENT NEWS

Begins on page 154

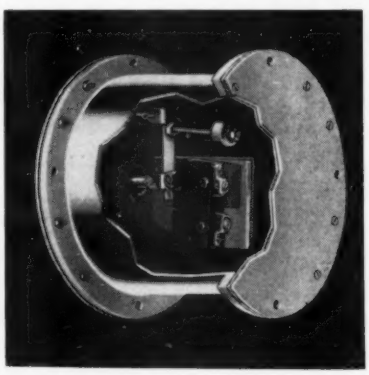
weight. Ideally suited for absorbing oil, greases, battery acids, gasoline, etc., as well as for cleaning hands.
Cottontex Mfg Co, Dept 110, 405 E Wells St, Milwaukee, Wis.



Capacitor-Run Motor

802 • Type CAP-2 is a single-phase motor that is capacitor-start and capacitor-run. It is made in 5, 7½ and 10-hp ratings, and is a 4-pole, 220-volt, 60-cycle unit.
Westinghouse Electric Corp, P O Box 2099, Pittsburgh 30, Pa.

For more data on these items, use post cards p. 163. Identify your request with item number.



Bin-Level Indicator

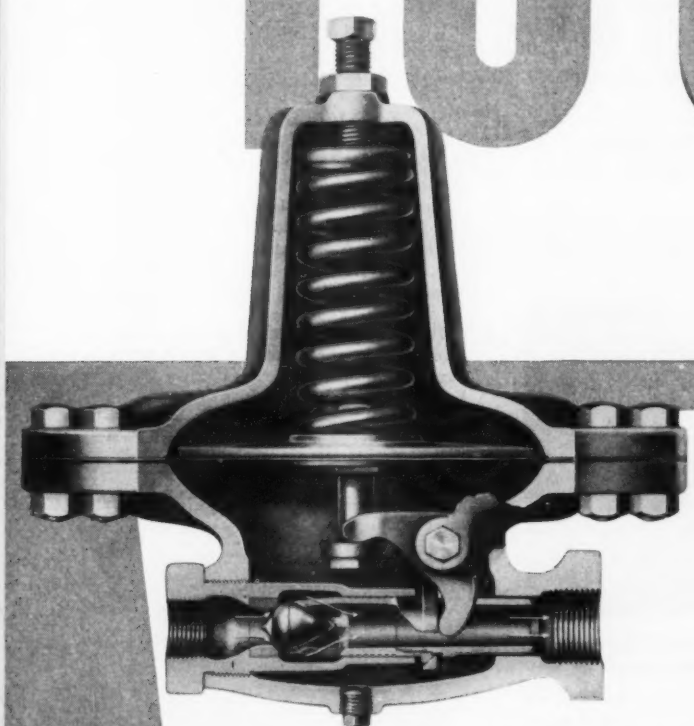
829 • New *Bantam Bin-Dicator* is designed to be mounted on the outside of thin-walled bins, inside of thick-walled or multiple-compartment bins, or suspended within bins. Unit has over-all diameter of 5¾ in., with a 4-in. flexible diaphragm that actuates a *Micro* switch. Back plate and counterweight limit diaphragm travel to minimum required to actuate switch.
Bin-Dicator Co, 152-13946 Kercheval, Detroit 15, Mich.

Controller

855 • New controller is especially adapted for cascade control systems and for program control. It has a motor-driven index.

Unit consists of standard thermometer controller plus an index-setting mechanism that includes a reversible motor, gear train, and two cam-actuated *Micro* precision switches. Motor-driven index travels at a

TYPE 1000 VALVE



Any product of quality should be dependable when *ordinary* products fail. Sudden pressure fluctuations, dirt, scale and viscous matter prove "fatal" to ordinary pressure reducing valves.

The CASH STANDARD TYPE 1000 VALVE however, is designed to operate with complete dependability under the most difficult and unusual circumstances. Many of these units have been in service over 10 years and have never been taken "out of the line."

Truly an *EXTRAORDINARY* achievement of quality and design excellence.

INSTALL CASH STANDARD "TYPE 1000" VALVES

CASH STANDARD **DECATUR, ILLINOIS**

A. W. CASH COMPANY

This NEW METHOD DRIES AIR

PRECISELY as you want it

- to control your product's quality
- to prevent condensation on your product or material
- to prevent changes due to moist air in contact with your product
- to protect your material from dampness
- to protect your processing of moisture-sensitive material
- to DRY your material or product
- to pack or store your product safe from moisture damage
- to get exact moisture control for the precise atmosphere condition you need
- to provide precise atmospheric conditions for testing
- to increase your air conditioning capacity
- to DRY large quantities of fresh air from outdoors

The Niagara's Controlled Humidity Method using HYGROL moisture-absorbent liquid is

Best and most effective because . . . it removes moisture as a separate function from cooling or heating and so gives a precise result constantly and always. Niagara machines using liquid contact means of drying air have given over 20 years of service.

Most reliable because . . . the absorbent is continuously reconcentrated automatically. No moisture-sensitive instruments are required to control your conditions.

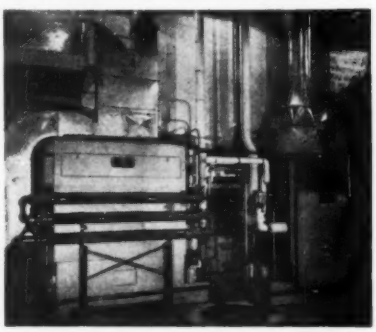
Most flexible because . . . you can obtain any condition at will and hold it as long as you wish in either continuous production, testing or storage.

Easiest to take care of because . . . the apparatus is simple, parts are accessible, controls are trustworthy.

Most compact, taking less space for installation.

Inexpensive to operate because . . . no re-heat is needed to obtain the relative humidity you wish in normal temperature ranges and frequently no refrigeration is used to remove moisture.

The cleanest because . . . no solids, salts or solutions of solids are used and there are no corrosive or reactive substances.



Niagara Controlled Humidity Air Conditioning

This method removes moisture from air by contact with a liquid in a small spray chamber. The liquid spray contact temperature and the absorbent concentration, factors that are easily and positively controlled, determine exactly the amount of moisture remaining in the leaving air. Heating or cooling is done as a separate function.

For complete information write

NIAGARA BLOWER COMPANY

Dept. P, 405 Lexington Ave., New York 17, N. Y.

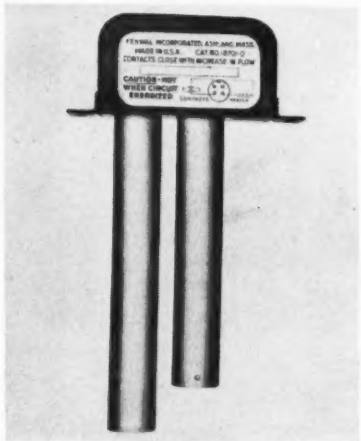
District Engineers in Principal Cities of United States and Canada

More EQUIPMENT NEWS

Begins on page 154

rate dependent on speed of reversible motor. Limiting indexes are set manually to stop motion of the driven index at predetermined points.

Minneapolis-Honeywell Regulator Co, Industrial Div, Wayne & Windrim Aves, Philadelphia 44, Pa.



Flow Detector

826 • *Detect-A-Flo* unit monitors either air flows or liquid levels. It can be used for any rate of air flow from 1000 to 50,000 lb per hr per sq ft, is said to respond to changes of 1 ft per second or less, depending on the flow rate and ambient temperature. As a liquid level detector, unit responds to changes in level of less than 0.1 in.

The detector is installed directly in the monitored area, requires no lead lines or auxiliary equipment.

Fenwal Inc, Ashland, Mass.

For more data on these items, use post cards p. 163. Identify your request with item number.

Electric Dehumidifier

856 • *Moisture Magnet* automatically removes excess water or moisture from air of enclosed spaces. Except for an electric outlet, no installation is necessary. Unit may be placed over an existing floor drain, or pails may be used for water collection.

Units are recommended for operation at room temperatures between 60 to 110 F, relative humidities from 40 to 100%. Two capacities are available—model K10-D has

meet the MARLEY man

who built the world's largest cooling tower installation.....

Andy Anderson, a Marley construction superintendent, may well point with pride to the world's largest cooling tower installation. Under his expert guidance, 55 carloads of prefabricated redwood lumber and Marley mechanical equipment were efficiently assembled into the giant Twin-Flow cooling tower installation you see.

Andy Anderson is typical of Marley's 22 construction superintendents whose average length of service with the company is 15 years. They all know cooling towers from the ground up, know how to get the job done efficiently and economically whether you or Marley furnish the labor. Each man has a wealth of cooling tower erection training and experience that fits him well for his important function in the Marley organization. Every member of this group is selected for his ability to cooperate fully with your engineering staff.

Whether you need 100- or 100,000-gallon cooling towers, Marley men like Andy Anderson supervise the installation. For complete details on the many advantages of putting your confidence in Marley products and Marley people, see your nearby Marley sales engineering office.

MARLEY®

The Marley Company

Kansas City, Missouri

It's the live-spring action and U-shape of the metal plies in Ajax Spiralwound Gaskets that permits them to give and take with varying pipe line or boiler stresses, to seal joints tight at safe bolt loads and utilize the pressures they are sealing against to keep them tight under all operating conditions.

There are types and sizes for all standard flanges and for manholes, handholes and tube caps for all makes of stationary and marine boilers, waterwalls, economizers, etc.

Materials of construction include plated low carbon steel or stainless, Canadian or blue African asbestos or chemically inert duPont Teflon.

Sold universally through industrial distributors. Ask your supply house or write—

UNITED STATES GASKET COMPANY

FABRICATORS OF "TEFLON" & "KEL-F" FOR THE CHEMICAL PROCESS & ELECTRONIC INDUSTRIES

CAMDEN 1 NEW JERSEY

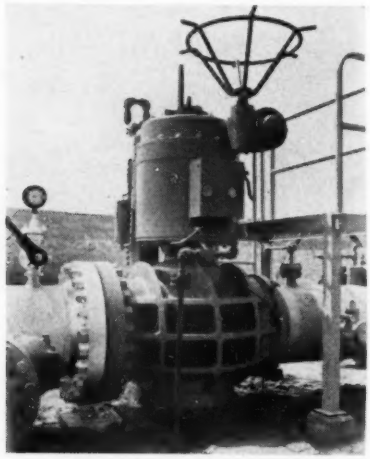
Representatives in Principal Cities Throughout the World

More EQUIPMENT NEWS

Begins on page 154

a 1 hp compressor, model K12-D has a 1½ hp compressor. Units operate on 208 or 230 v, 50 or 60 cycles, single or 3-phase current, and 230 v, dc. Bulletin 531.

Remington Air Conditioning, Div of Remington Corp, Auburn, N. Y.



Plug Valve Operator

811 • Unit can open or close a 24 in. plug valve in two seconds without mechanical shock, it is claimed. Plug valve operator can be installed on existing 1½ to 30 in. valves. It may be powered with gas, air, or liquid at presures from 60 to 1000 psi.

The single moving part applies torque directly on and about the valve stem like a two-handled wrench. Available for manual, cyclic, or automatic remote control with pneumatic, hydraulic or electric initiation.

Although principally used on high-pressure gas lines, unit is readily adaptable to industrial plant use.

Shafer Valve Co, Inc, 2442 W 4th St Road, Mansfield, Ohio

For more data on these items, use post cards p. 163. Identify your request with item number.

Safety Switches

857 • New line of standard duty safety switches type HCI, is available in ratings of 30, 60, 100 and 200 amps, 240 and 600 v, 2, 3 and 4 poles. Pole unit features an arc-quenching action that is similar in principle to the arc-extinction features of circuit breakers. The units have quick-make quick-break action, interlocking cover and hp ratings, meet NEMA type A standards.

Trumbull Electric Dept, General Electric Co, Plainville, Conn.

Zeolite Softener Cleaner

858 • *Zeotone* is said to clean and tone up the zeolite or resin bed in commercial or industrial water softeners. Manufacturer claims it will loosen iron deposits, silt and other material that becomes trapped in the softener bed. Cleaner can be used on any softener that is regenerated with salt. Bulletin available.

Calgon, Inc, Hagan Bldg, Pittsburgh 30, Pa.

HALL INDUSTRIAL WATER REPORT

Hall Laboratories, Inc.—A Subsidiary of Hagan Corporation, Pittsburgh, Pa.

Volume 1 | AUGUST 1953 | Number 4

Coal Washer Maintenance Costs Cut in Half

Maintenance costs on the coal washer for a big steel plant were running as high as $18,000 a month when Bill O'Brien, Hall field engineer, was consulted. The main trouble in the washing process arises when iron pyrites in the coal come in contact with air and water. Sulphuric acid is formed, and plays hob with the equipment. Drawing on his experience with similar situations, Bill prescribed treatment of the wash water with Banox* corrosion inhibitor. Maintenance has already been cut in half, unscheduled shutdowns have been eliminated, and further improvement can be anticipated.

Water is your industry's most important raw material. Don't waste it.

Epsom Salt Sales Boom in West

Hall-man Hankison of Denver reveals what associate W. C. Bennett did to keep a client happy.

A new 1500 psig boiler filled with raw water required fast silica reduction. No magnesium compounds were available at the plant for the purpose, so Bennett went to a drugstore and asked the clerk for five pounds of Epsom Salts. The clerk looked startled, the order was repeated, and the sale made.

Only five pounds wasn't enough. So the next evening he returned to the drugstore for an additional five pounds.

This was too much for the clerk, who braced himself firmly, looked Bennett squarely in the eye, and said explosively, "What FOR?"

Report Shows Scope of Hall Service

The following extracts from a recent report of Basil Welder, Hall Service Engineer, demonstrates what is meant by "Hall Plant-Wide Water Service." The Hall Service Engineer is not only informed on industrial water but is also alert to the many factors of operation and layout which affect results.

- Persuaded steel plant to make mechanical changes in open-hearth door frames to improve cooling.
- Located leak of clay slip into condensate return system of ceramic plant.
- Introduced Hagafilm* for control of corrosion in condensate return system of glass plant.
- Established system for treating water in five air-conditioning systems in large department store.
- Recommended special filter to plant manufacturing compressed gases, reducing oil in condensate to insignificant level.
- Used Burosil* in boilers of synthetic-fuels laboratory to get rid of sludge through precipitation of magnesium.
- Prepared survey of alternative systems of primary treatment of feedwater for new boilers of steel plant.

Lamme Medal Awarded Dr. Hall

The Benjamin G. Lamme medal, one of Ohio State's top honors, was awarded to Dr. Ralph E. Hall at the spring quarter commencement exercises. Dr. Hall received the award for meritorious achievement in engineering.

Said the Ohio State Lantern in announcing the award, "Not only is Dr. Hall credited with the development of water conditioning into an exact science based on sound scientific principles, but his contributions to the entire power industry are considered invaluable. Today the Hall system of boiler water treatment is practically standard throughout the world."

From its founding in 1926, until his retirement in 1950, Dr. Hall was director of Hall Laboratories. He still serves as a consultant to Hall Laboratories on both research and development problems in their work as water consultants to industry.

Dr. Hall is the author of 64 papers, and some 54 patents have been issued on Hall processes. He is a member of the American Chemical Society, the American Society of Mechanical Engineers and two national honorary societies, Phi Beta Kappa and Sigma Xi.

Industrial Water Problems Require Special Handling

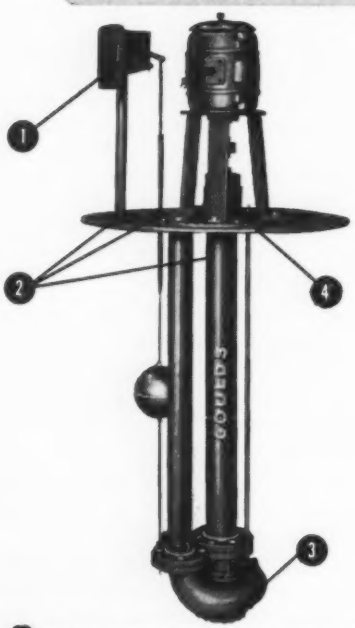
There are no "stock answers" to industrial water problems, for information, write, wire or call Hall Laboratories, Inc.

*"Banox," "Hagafilm" and "Burosil" are registered trademarks. "Hall System" is registered as a service mark by Hall Laboratories.

For Removing Water from Boiler Room Pits...

Goulds

Vertical Centrifugal Pumps

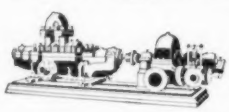


This Goulds sump pump (Fig. 3047) is widely used for removing water from pits in boiler rooms and powerhouses. Pump itself is submerged in pit and connected to motor by vertical shaft. There is no suction pipe.

Pump is built in four sizes for pit depths from 3 to 20 ft. Capacities 10 to 650 G.P.M. Heads to 65 ft.

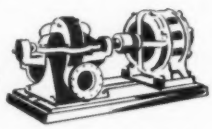
1. Unit complete with float and automatic switch which starts and stops pump according to levels in the pit.
2. Permanent alignment of upper and lower bearings is assured by welding together the cover plate, supporting column and discharge pipe.
3. By-passing water through casing ports equalizes pressure on both ends of bearing bushing, prevents flow of liquid through bearing and assures retention of lubricant over long periods of time.
4. Shaft and impeller can be adjusted axially *without dismantling any part of the pump.* Upper bearing and bearing housing are assembled as a unit with shaft and impeller.

Other GOULDS PUMPS for power applications



GOULDS Fig. 3360

High pressure multistage centrifugal. Capacities to 2250 G.P.M. Heads to 3050 ft. Bulletin 722.5.



GOULDS Fig. 3450

These double-suction, single-stage Goulds centrifugals will handle up to 15,000 G.P.M. Heads up to 500 ft. Send for Bulletin 721.2.

GOULDS Fig. 3650

"Close-coupld" single-stage centrifugal for general industrial use. Capacities to 2000 G.P.M. Heads to 400 ft. Bulletin 710.1.

For complete information contact your nearest Goulds distributor or write for Bulletin 726.1.

MEMBER HYDRAULIC INSTITUTE U.S.A.

Goulds PUMPS INC. Seneca Falls New York

WATER GAGES

Continued from page 84

After disassembly of a gage, carefully inspect all parts that will be used again in gage. For instance, a body groove that takes a gasket must be thoroughly cleaned so new gasket has a good surface against which to seal. Don't damage gasket seat in any way.

Clean cap-screw threads and paint with high-temperature lubricant (a high-grade mineral oil). Don't use graphite on a gasket surface when reassembling gage. Carbonization and build-up may occur at high temperature when graphite is used.

Don't reuse mica, glasses or gaskets. Though glass may look perfect it may have lost some of its original properties. Leave new gage parts in their protective wrapping until they can be immediately assembled in gage. If gage manufacturer gives preheat instructions for gaskets, be sure to follow them.

Keep all metallic objects away from glass before and after assembly. Adjust glands on gage valves to prevent leakage but do not tighten excessively. Lubricate stem and yoke bushings periodically. Keep valves wide open.

Choosing Gage. Before deciding which gage is best for your job, check with the manufacturers. They can supply a list of plants near you that use their gages under similar conditions.

Look at the design from an engineering standpoint. Your experience gives you a good lead on whether the gage will do the job. Compare your choice with others suitable for the same work.

Once you've chosen the gage, specify the exact unit you want, or pass your recommendation to your planning group, consulting engineer or boiler manufacturer. They'll particularly appreciate your recommendation because they know it is based on down-to-earth experience.

WITH OUR READERS

Continued from page 5

it's Volume X in which the editorial appeared. At that time, POWER ran yearly volumes, as we do today, so there's another indicator pointing to 1880 as the starting date of the parent paper, *Steam*.

When we began to dig into what now shapes up as a nice little mystery, we found that while our library of POWER is complete back to the beginning, we don't have the early issues of *Steam*. And we found that the first issue of POWER is labeled Volume IV—still another trail leading back to 1880 rather than 1882.

If POWER is older than we think, we want to know about it. So if you can help us in nailing down the facts, we'll be grateful. And we have in mind a real reward for the reader who first comes forward with the evidence.—*Ed.*

'SAIRSET

For the past 28 years, 'SAIRSET has been recognized as the finest quality air-setting, high temperature bonding mortar on the market. It forms a thin, airtight joint and bonds all types of firebrick into a one-piece unit at all temperatures. The high refractoriness of 'SAIRSET guards against fusion or softening of the joints ... increasing the service of the firebrick.

A. P. GREEN BONDING MORTARS

ADD EXTRA LIFE AND PROTECTION TO FIREBRICK LININGS . . . REDUCE DOWN-TIME

KD-2

An air-setting, high temperature bonding mortar that will not fuse or soften in the joints. KD-2 develops excellent plasticity and workability immediately on mixing — no long soaking period required. Gives maximum protection because it does not shrink ... there are no cracks for flame and slag to attack. KD-2 is shipped dry and will not freeze, deteriorate or lose its working and bonding characteristics in storage.

DIAMOND-JO

A dry, heat-setting high temperature mortar for laying firebrick. DIAMOND-JO is free from joint shrinkage or expansion ... provides strong airtight joints at high temperatures ... recommended for temperatures above 2000° F. It is ground extremely fine ... makes thin brick-to-brick joints.

FOR SPECIFIC RECOMMENDATIONS, without obligation, on your refractory problems or requirements, call your local A. P. Green distributor ... he is listed in the yellow pages of your telephone directory ... or write direct.

A. P. Green REFRACTORY PRODUCTS

A. P. GREEN FIRE BRICK COMPANY
Mexico, Missouri, U. S. A.
In Canada
A. P. GREEN FIRE BRICK CO., LTD.
Toronto 15, Ontario

DISTRIBUTORS IN THE PRINCIPAL CITIES OF THE WORLD

Original installation or extension of existing heating plants—

Ray Service is always handy!

Wherever you are, whatever type of burner your specifications call for...a capable Ray Franchised Dealer is at your service to help you plan and to complete your burner installation.

Ray dealers are part of a team which has been growing in size and efficiency for 81 years. Modern facilities and techniques combine with experience to provide the best oil burner service you can buy. That is why today *"Every third rotary oil burner in service is a Ray"*.

Contact the Ray Dealer nearest you and take advantage of this complete engineering and installation service.

***Rely on your Ray Dealer*—you'll find his name in the yellow pages of your telephone directory.**

There is a Ray Burner for every purpose from 3 to 1,000 H. P. firing oil, gas, or gas-oil combination.

RAY OIL BURNER CO.

1301 San Jose Avenue • San Francisco 12, California
Atlantic Seaboard Div. • 629 Grove St. Jersey City 2, N. J.

DIESEL GOVERNORS

Continued from page 87

no load, both set their fuel controls for half load because they are running at 5% overspeed. Each engine continues to carry its proper share of the common load.

But if governors have different speed droops, say 5% for one engine, 10% for the other, load will not be equally shared. For instance, if a load decrease speeds up both engines 5% as before, first engine's governor cuts off *all* its fuel so no power is delivered, while second engine will develop half power. Governors of engines connected together must have equal speed droops if each is to automatically take its correct share of a varying common load.

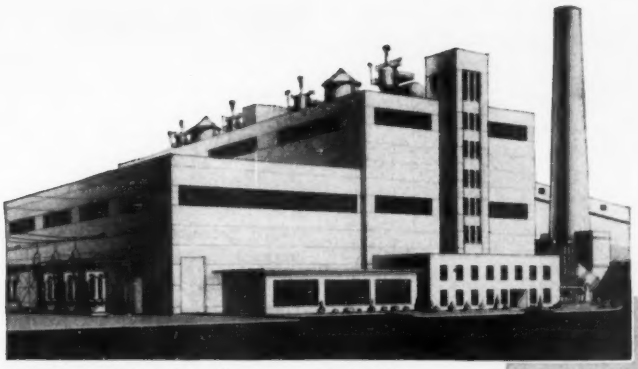
Adjustable Speed Droop. Usual mechanical governors have fixed and fairly large speed droops. So if two or more engines have different makes of mechanical governors, their speed droops will probably differ considerably. If the engines are coupled to a common load, they will not take their proper share when it varies.

Nonisochronous hydraulic governors have inherent permanent speed droop, which is generally adjustable (Fig. 6, p 100, May). Such governors, when fitted to coupled engines, may be adjusted for equal droop to give correct load sharing. This generally requires a speed droop of 2 or 3%. Since speed droop is always present in such governors, they will not keep constant frequency in ac-generating plants. Consequently, electric clocks will not keep accurate time unless a watch engineer or automatic device frequently corrects all engine speed-adjusters.

Isochronous hydraulic governors without speed droop (p 82, June) work well on engines running *singly*. But they are unsuitable for coupled engines because absence of speed droop prevents proper load sharing.

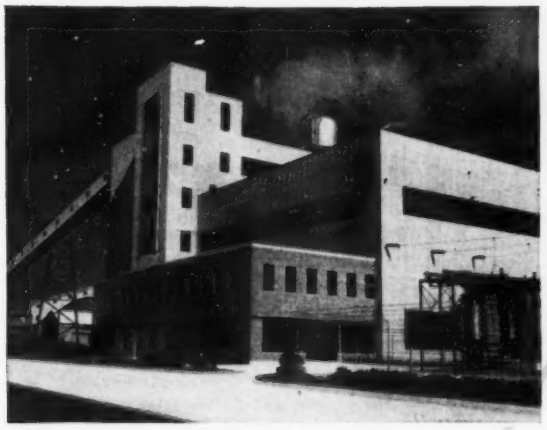
So, isochronous hydraulic governors with adjustable speed-droop attachment, Fig. 2, 3 and 4, find wide use in multiple-unit ac-generating plants. Because their temporary speed droop gives them stability, the permanent speed droop can be made quite small and still give good load sharing.

Also, such governors permit parallel operation at *constant frequency*. Governor of one engine is set for zero speed droop (isochronous), and all other governors are given equal speed droop of sufficient amount to insure correct load sharing. Load changes are automatically taken by engine with isochronous governor, which runs at constant speed. This compels other engines to maintain their same speeds, so electrical frequency of plant stays constant. In this

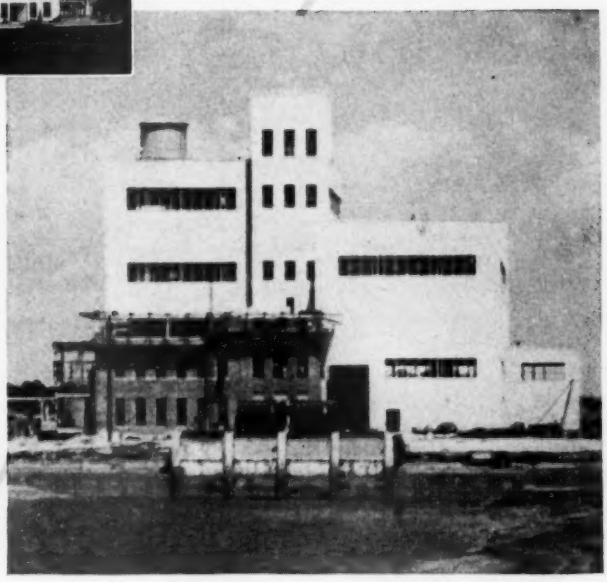


Yates Plant at Whitesburg, Georgia, was dedicated in October, 1952.

Oh, I see



McManus Plant near Brunswick, Georgia, went into service in November, 1952.



Hammond Plant near Rome, Georgia, will go into service late in 1953.

...they're using our valves at Georgia Power

Newest in their growing chain of giant power plants for expanding service in Georgia are these three plants. Indicative of their builders' desire to assure maximum dependability is their selection of OIC Valves for these plants.

Every OIC Valve is *precision-engineered* and *precision-made* to give longer, trouble-free service at no extra cost to you. OIC offers *precision-application help* in selecting valves best suited to each job.

THE OHIO INJECTOR COMPANY
Wadsworth, Ohio

OIC
FOUNDED 1883

VALVES . . . **FORGED & CAST STEEL, IRON & BRONZE**

Why you will continue to buy R-P&C iron valves...

• Because quality materials and high standards of workmanship insure long life and satisfactory performance.

R-P&C manufacturing controls from foundry to final test, together with the many years of accumulated experience of the workmen, are responsible for this high quality.

You get fine-grained, sound castings when you buy R-P&C Iron Body Valves. You get rod stock stems which have higher tensile strength. And you get the added strength of reinforcing tie ribs between bonnet and end flanges, plus ease of servicing because of separate yoke cap construction.

the Complete R-P&C line

BRONZE
IRON
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• *All these features are yours, at no extra cost, when you buy R-P&C Iron Body Valves. See your local R-P&C distributor today or write us at Reading, Pa., for further information.*

ACCO

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AMERICAN CHAIN & CABLE

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TRADE MARK

R-P&C valves

DIESEL GOVERNORS

Continued from page 194

arrangement, engines with speed droop deliver constant output. Therefore, engine with isochronous governor must have enough capacity to take all load changes.

Variable-speed governors are used where operator must be able to change engine's speed while it is running. Output of pumps and compressors is varied efficiently by varying the speed. Governors of this type not only make speed changes easy; they also keep engine under governor control at the speed operator selects.

DEMINERALIZATION

Continued from page 91

members inside the multiport body should have soft rubber disks that can be compressed against the seats to be absolutely drop-tight to avoid any leakage. The slightest leakage would contaminate the final effluent.

Regeneration Equipment. Various schemes of measuring the amount of regenerant and controlling its dilution have been used. The trend is away from dilute-acid tanks because they raise the problems of corrosion and leakage. You can store strong acid economically in tank cars, and drop a gravity line from there into a strong acid-measuring tank, using probes to control the volume of acid introduced. Pumps either of the reciprocating or centrifugal type introduce the acid from these measuring tanks into the cation unit being regenerated. You can then mix raw water for dilution with the strong acid on the discharge side of the pump. The flow rate of strong acid and of dilution water should be automatically controlled, to accomplish the desired strengths, especially for the 4-step regeneration technique.

For the anion unit, caustic soda in liquid form can also be stored in large tanks for the larger plants. This caustic soda usually comes in a strength of 50%, and can be dropped by gravity into a measuring tank operated the same way as for the acid. Dilution control, too, follows the same procedure. In addition, you can locate a steam heater in the caustic lines with a thermostatically controlled steam valve to maintain a 95-F temperature in the final diluted and heated caustic-soda solution.

Fig. 5 gives a flow diagram of one case where even the regenerant-measuring tank has been omitted. In this case the acid and caustic soda pump directly from large storage tanks through ratio-control equipment into the unit being regenerated.

(*Continued on page* 198)

COCHRANE WATER CONDITIONING
STARTS WHERE NATURE STOPS

AT PENNSYLVANIA ELECTRIC CO.
IT'S A COCHRANE DEMINERALIZER

Cochrane Demineralizer Installation at Pennsylvania Electric Co., Erie, Pa.— Gilbert Associates, Inc., Engineers, Reading, Pa.

• To supply high quality water for boilers operating at 1250 psig the Pennsylvania Electric Company installed a Cochrane Automatic Demineralizer in their Erie, Pa., Power Station. Designed for silica removal, this unit handles 400 GPM in preparing make-up for the boilers.

Demineralization is one of many "water problems" Cochrane's engineers solve every day. Water softening, dealkalization, and deaeration are others—all complex—all requiring expert and specialized knowledge. Whether for process or boiler feed water Cochrane can supply the answer to your particular problem, backed by 90 years' experience in solving industrial water conditioning problems. You'll be sure of unbiased recommendations because Cochrane designs and builds all types of water conditioning equipment.

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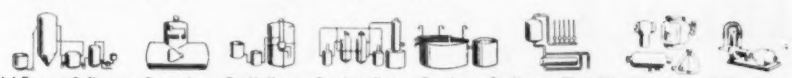

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2. Twenty-three offices and three branch factories—with stocks of Garlock products—situated in most principal cities throughout the United States—convenient to you for prompt shipments and competent service.

3. Factories, laboratories, service engineers, resident engineers and pilot plant at Palmyra, New York—with background of sixty-six years' experience in the manufacture, application and development of superior quality mechanical packings—GARLOCK—The Standard Packing of the World.

This is the Garlock picture—unique in the mechanical packing industry. Take full advantage of it. It is yours for the asking.

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MECHANICAL SEALS,
RUBBER EXPANSION JOINTS

DEMINERALIZATION

Continued from page 196

Vacuum Deaerators. Where the demineralized water passes through some heat-exchanging equipment so its temperature increases, it may be advisable to remove the dissolved oxygen to minimize steel-piping corrosion, etc. A vacuum deaerator, Fig. 5, instead of the usual degasifier does the job well.

Instrumentation. Excess acid in the regeneration of cation units must be rinsed out before the run starts. But you need help in the way of instrumentation to tell the exact end of the rinse. When the actual acidity present approaches the theoretical mineral acidity equivalent to the sulfates and chlorides, then you have reached the ideal point to start the cation-unit run and have the acidity remain fairly constant until the end of the run. At that point where the run should end, the acidity decreases, which means that the pH rises, Fig. 4, and the conductivity decreases because of the fall in the acidity. This conductivity is frequently easier to measure than pH. A solubridge conductivity indicator furnished with each cation unit serves this purpose in fine fashion. Equip it, though, with extra cells so the strength of the acid introduced during regeneration can be measured on this indicator.

Excess caustic soda required in the regeneration of anion units must also be rinsed to waste. Since caustic soda has a high conductivity, it shows up on the conductivity solubridge indicator. With a desired starting point, say of 3 ppm of total electrolyte, its equivalent, 15 micromhos of conductivity, is marked on the solubridge indicator and when that valve is approached it is time to end the rinse. During the run the conductivity decreases still further, and at the end the conductivity rises as the electrolyte breaks through.

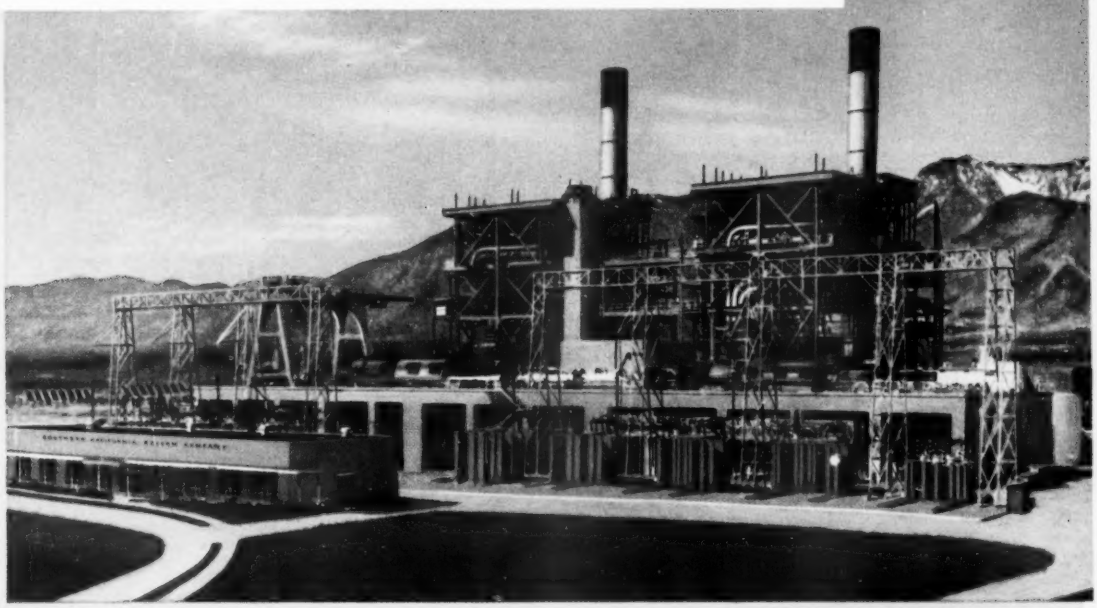
But, silica usually breaks through first. Unfortunately its conductivity is very low and, therefore, its breakthrough may escape the conductivity indicator. As a result, you make silica tests toward the end of the run and watch for the break-through, Fig. 6.

One possible warning of silica breakthrough can come from submerging a sampling point about halfway down in the anion bed, and running this sample continuously through a solubridge indicator. Conductivity increase, at this halfway sample point, may be synchronous with silica break-through from the bottom of the bed.

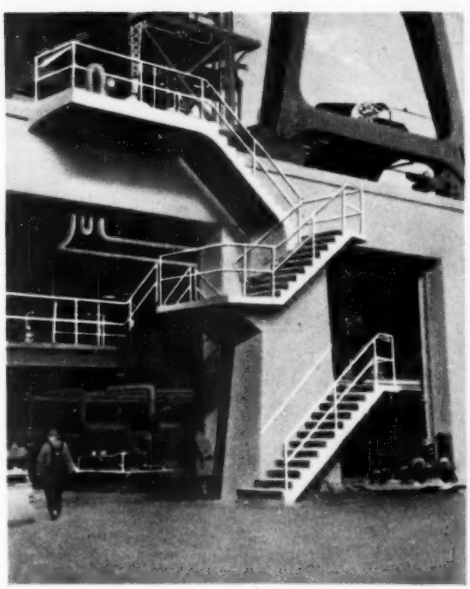
It pays to put in suitable flowmeters on the individual units so you know the total water treated by each unit. When you pair a cation and an anion unit and regenerate them at the same time, one

ETIWANDA

Economical as all Outdoors



Etiwanda Steam Station of Southern California Edison Company, located in the fast-growing Fontana District near Los Angeles, has an initial capacity of 250,000 kw. It was designed and built by Stone & Webster Engineering Corporation, in collaboration with the client's engineering department.



Etiwanda Steam Power Station was designed for efficiency, ruggedness, simplicity – and economy.

The station, largest in the country to use cooling towers for circulating water, is almost entirely "outdoors". This and other features of the design have achieved outstanding economy in plant cost combined with high thermal efficiency and minimum operating costs.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY *of* STONE & WEBSTER, INC.

Largest "S" Monel Pump Impeller ever cast at Inco's foundry. This 3,023-pound impeller is installed in an 84-inch Morris Vertical Axial Flo pump, at a generating plant of DOW CHEMICAL COMPANY, Velasco, Texas. The pump was built by the MORRIS MACHINE WORKS, Baldwinsville, N. Y., and is capable of handling 120,000 gpm at a total discharge head of 10.5 feet. It will operate in brackish water taken from the Gulf of Mexico. Because of Dow's experience with these corrosive conditions they selected "S" Monel for the impeller as a precaution against costly shut-downs. And for added protection, they also specified centrifugally cast pump sleeves of Monel.

"S" Monel...

an extra-hard casting alloy for parts subject to the severe conditions of power plant service

A time usually comes when you need a corrosion-resisting alloy of above-average strength and hardness.

Then it pays to remember "S"® Monel.

This member of the Monel family is one of the *strongest* and *hardest* of the non-ferrous alloys available in cast forms. Because of its hardness, of course, "S" Monel is highly resistant to abrasion and erosion. What's more, it combines the excellent corrosion-resistance of Monel with two particularly valuable features:

— extra hardness at high temperatures
— resistance to galling and seizing

Worth keeping in mind, too, is that "S" Monel maintains a hardness nearly as great as heat-treated steel. Temperatures as high as 1000°F. have but slight effect on its hardness.

And "S" Monel is machinable as cast. Where extensive machining operations are called for, the casting may be annealed. Age-hardening later will develop maximum hardness.

It is this combination of exceptional properties that makes "S" Monel so useful in valve discs and seats, wearing rings, bushings, sleeves, ejector nozzles, pump liners and impellers.

In your own plant, there are probably many places where Inco-Cast "S" Monel parts could contribute to the improved performance of parts subject to high stress, high temperature and severe friction under corrosive conditions. You can get complete information on "S" Monel — and assistance on actual problems, too — simply by writing to Inco's Technical Service Section.

It is advisable to place equipment orders with your supplier well in advance of scheduled use. Distributors of Inco Nickel Alloys can supply the latest information on availability from warehouse and mill.

THE INTERNATIONAL NICKEL COMPANY, INC.
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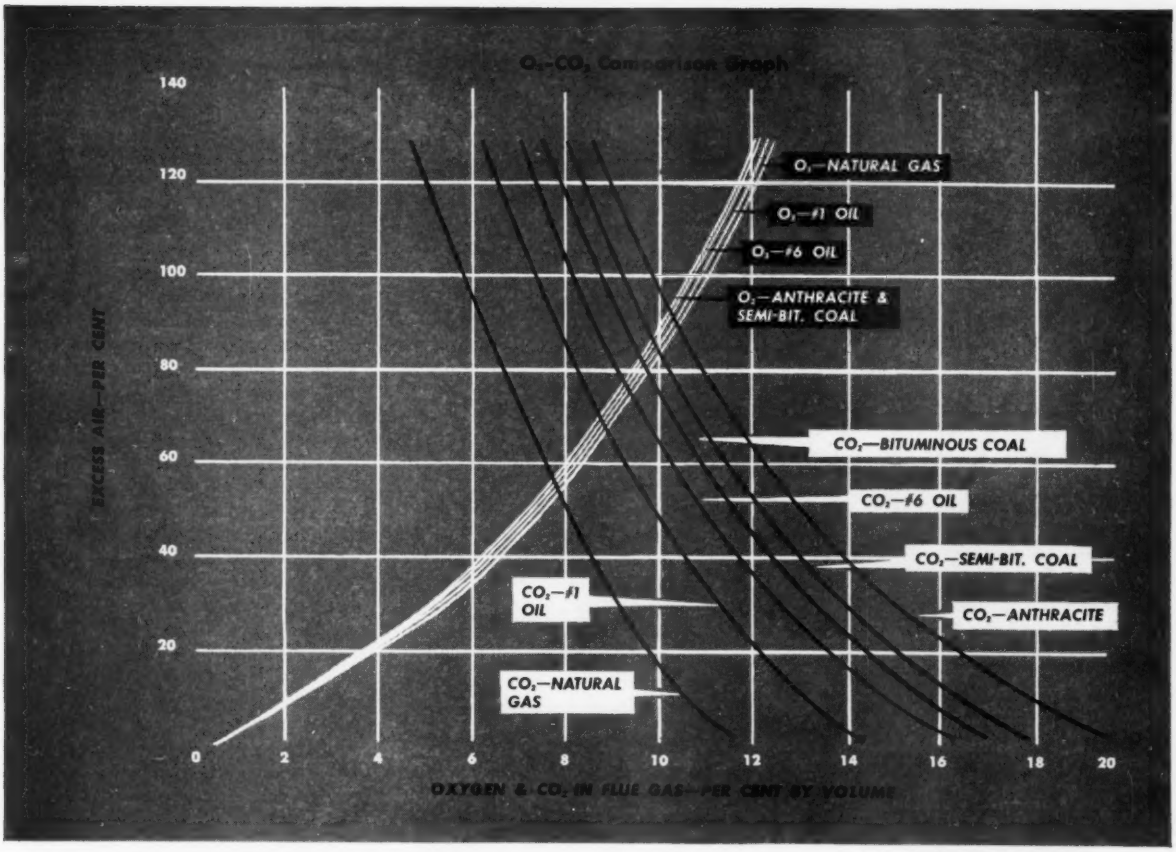
NICKEL • LOW CARBON NICKEL • DURANICKEL®



HOW TO BURN Multiple Fuels EFFICIENTLY

When switching from one fuel to another or burning more than one fuel at the same time, you can realize large savings with a continuous indication of Oxygen content in your flue gas—because Oxygen and Oxygen alone gives you an undistorted picture of the amount of excess air present.

This fact is borne out by the graph showing the relationship of excess air to CO_2 and O_2 in the flue gas of five common fuels. While the O_2 curves nearly coincide (especially in the important 30% excess air range) the CO_2 curves diverge widely.

Large savings possible

This deviation was costing a medium sized refinery in Michigan $35-40 per day in boiler room fuel costs. Burning a combination of oil and gas they found that a combustion control system to handle their multiple fuel firing conditions would cost more than their small boilers.

With the purchase of a Hays Magno-Therm Oxygen Recorder, they found that they were able to reduce fuel costs enough *to pay for the instrument in 40 days.*

Oxygen and Oxygen alone gives you an undistorted picture of the amount of excess air present.

If you are facing the problem of multiple fuel combustion, you will want a detailed copy of this O_2-CO_2 Comparison Graph as well as Hays Bulletin 52-829-56 — describing the Magno-Therm Oxygen Recorder. Write for this free information.

With the Hays Magno-Therm Oxygen Recorder you get:

- *Continuous, highly accurate indication and recording.*
- *Complete compensation for temperature and pressure effects.*
- *Freedom from chemicals or hazardous fuel burning in the analyzing process.*
- *Swift, sure electronic operation.*

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Wallace & Tiernan equipment because it is versatile, sturdy and dependable — proven by thousands of successful installations, vouched for by satisfied users everywhere-and because there's a Wallace & Tiernan chlorinator for every job. Write today for information on how Wallace & Tiernan chlorination may help you solve *your* slime problem.

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regardless of the source. Chlorination helps reduce slime in make-up or cooling water.

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DEMINERALIZATION

Continued from page 198

integrating meter on the inlet to the cation unit can serve for both units. In larger plants you'll find a recording flowmeter both on the common inlet and outlet of the demineralizer. The difference in water that these two meters indicates shows amount of waste water.

Recording conductivity meters, also desirable on the common effluent, have a contactor to sound an alarm when the conductivity rises above the desired limit. In addition, they may have several cells to test influent as well, where it is variable in composition, so the operator can determine the expected total gallons between regenerations.

Recording pH meters on the final outlet, installed with a contactor, also sound an alarm if pH drops too low.

Precautions. 1. When you use degasifiers in a dusty location, put air filters on the air-blower suction to avoid contaminating the anion bed.

2. Where organic matter appears in appreciable amounts in the raw water, eliminate it as far as possible, to avoid contaminating the anion bed.

3. When you encounter high amounts of nitrate in the raw water a 3- or 4-bed system, using Rohm & Haas IR-45, or Nalcite WBR, will remove the nitrates when regenerated with caustic soda. This solution saves operating costs and protects the important final silica-removal unit.

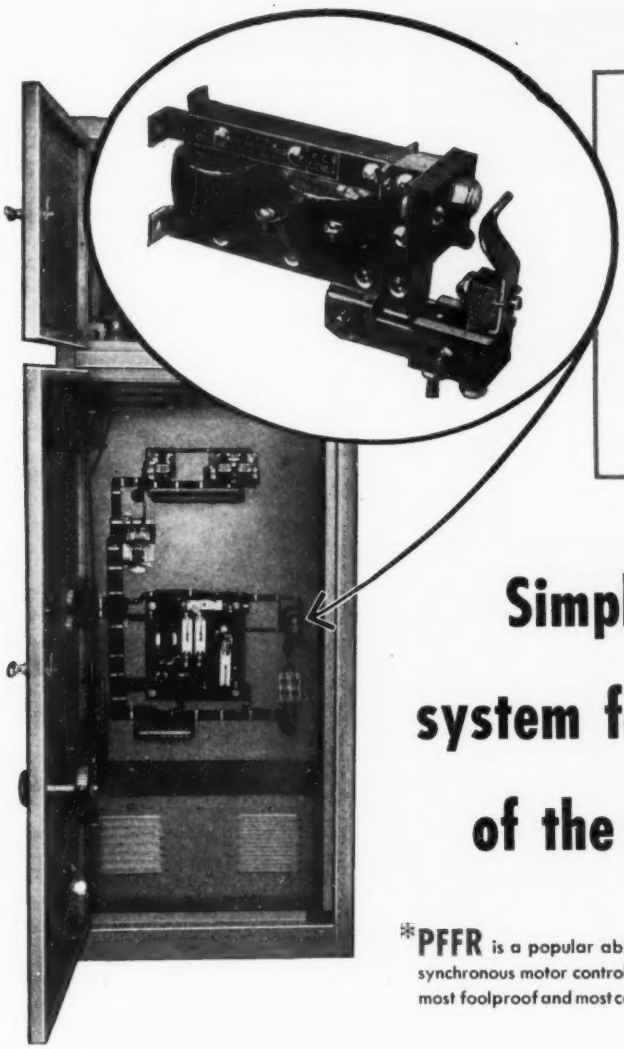
4. Always regenerate the anion unit with demineralized water or cation effluent to avoid precipitating hardness on the anion resin.

5. Specify the so-called "rayon" rather than the "bottoms" type of caustic soda. It is relatively iron-free and avoids contaminating the anion resin.

6. Allow at least 24 hours for runs between regenerations to assure the highest quality of average effluent throughout the day.

Properly run 2-bed demineralizers produce final effluents, averaging 1 to 2 ppm of total electrolyte, and 0.05 to 0.1 ppm of silica. The endpoints are usually double these figures.

Mixed-Bed Demineralizing. A development of Rohm & Haas, about 1950, consists of placing both cation and anion resins in a single shell and mixing them together by air. At the end of the run, backwashing classifies the cation and anion resin particles hydraulically. The lighter anion bed rises to the top and the heavier cation bed drops to the bottom so they can be regenerated separately in place. A screened collector-pipe system goes in at the interface between the two beds. A regenerant pipe system distributes the caustic soda above the anion bed and passes it down-



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Simplest, most reliable system for "conscious" control of the synchronous motor

*PFFR is a popular abbreviation for the Polarized Field Frequency Relay system of synchronous motor control, invented by E-M and generally considered to be the simplest, most foolproof and most completely effective starting and synchronizing system available.

● It's so simple...a reactor, and a relay with two small coils do your synchronizing easily, automatically and right. No fussy, complicated mechanisms to get out of order . . . PFFR has few parts, is easy to understand, requires only routine attention.

PFFR is sensitive to the electrical condition of the motor field winding during starting . . . field excitation is applied at the proper rotor angle for maximum synchronizing torque with minimum current inrush. PFFR Control is "conscious", interpreting best motor speed and rotor position. Motor pulls in step without pole slippage or "bumping".

And should the motor pull out of step in operation because of undervoltage or overload conditions, PFFR reacts to remove field excitation. When time delay undervoltage protection and automatic unloading are provided, PFFR will automatically re-synchronize motor when voltage is restored or peak load is passed.

To get the best operation from your synchronous motors, specify E-M PFFR Synchronous Motor Control. It's a product of long, specialized experience. Your nearest E-M sales engineer can give you complete information on synchronous motor controls and protection systems. And write for your copy of "The ABC of Synchronous Motor Control".

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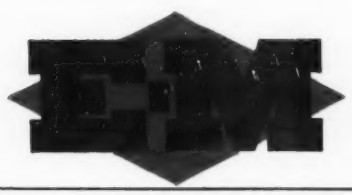

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DUAL CONTROL means ECONOMY

with NATIONAL AIROIL Universal Registers

AND TYPE "S-A-L" OIL BURNERS

. . . and economy means that you get better performance with NATIONAL AIROIL Universal Registers because they have a dual feature for controlling air volume independent of turbulence. Air vanes can be instantly reversed to change direction of turbulence while air volume is separately regulated by a refractory faced disk control. Both adjustments can be made while the Type "S-A-L" Oil Burner is firing.

Another "dual advantage" of NATIONAL AIROIL Universal Registers is that they are equipped for dual fuel firing of gas and oil.

Universal Registers with Type "S-A-L" Burners are available in three (3) sizes . . . capacities up to 60,000 lbs. of steam produced per burner per hour. Write for Bulletin 51.

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INDUSTRIAL OIL BURNERS, GAS BURNERS, FURNACE EQUIPMENT

DEMINERALIZATION

Continued from page 202

ward through this bed and out through the interface collector to waste. Similarly acid regenerates the cation bed upward, and goes out through this interface system. To avoid caustic soda reaching the cation bed or acid reaching the anion bed, small streams of demineralized water are passed countercurrent to the direction of regenerant and out through the interface system.

A perforated screened plate at the bottom with fine openings serves as the usual underdrain system for small and medium-sized units. This screening under the resin beds, substitutes for any granular subfill that may contaminate the effluent.

Results, as far as total electrolyte go, are superior to the 2-bed system, with an effluent having only 0.1 to 0.2 ppm of total electrolyte. The reason is that the mixed bed is in effect a number of separate 2-bed systems in series because an anion resin particle lies alongside a cation-resin particle and removes the acid it produces. Cation leakage is practically eliminated.

This extremely low electrolyte seems important for certain delicate industrial applications, but we feel it is of minor significance for boilerfeed makeup water because supplementary chemicals such as sulfite, phosphate, usually added for boiler protection, build up the electrolyte content. There is a difference of opinion as to whether the silica is lower after the mixed-bed than after the 2-bed system.

Mixed-bed disadvantages are:

1. You need a crystal-clear influent because any turbidity accumulates in the bed and does not backwash out without washing out the lighter anion particles. In 2-bed systems the cation bed protects the anion bed, and suspended matter can be more readily backwashed out.

2. The influent must be iron-free to avoid iron contamination of the anion unit.

3. Some of the ion-exchange particles do not completely separate after backwashing, and hence regenerant does not reach them so the resin capacity suffers.

4. Operating cost is usually higher, especially with an appreciably alkaline raw water. In these cases you install a cation hydrogen exchanger followed by a degasifier ahead of the mixed-bed unit. And this increases the investment.

But mixed-bed units are going in. Hartford Electric Co, at Hartford, Conn., is one illustration and results may be available soon. They may prove economical for raw-water cases of fairly low total dissolved solids and particularly low alkalinity.

CONTROL PIPELINE MOTION this dependable, maintenance-free space-saving way

6" I.D. Flexon dual controlled flexing expansion joints on 300 psi steam lines and 3" I.D. dual Flexoniflex units on condensate return line.

with FLEXON EXPANSION JOINTS

Eliminate the dangers of pipeline motion easily and permanently by installing Flexon Expansion Joints. These units are compact and easily installed. They can not leak and require no packing or maintenance of any kind. Just install them and forget them.

Flexon Expansion Joints are offered in three types—Free Flexing in copper or stainless steel for pressures to 30 psi—Controlled Flexing in copper or stainless steel for pressures to 300 psi—High Pressure Flexoniflex units in stainless steel for pressures to 5500 psi. All stainless steel pressure carriers withstand temperatures to 800° F. (1600° F. with special alloys). Copper models pressure and temperature rated according to code. All models are suitable for handling radial, axial and/or lateral pipeline motion.

Write for the name of your nearest Flexon representative.

Complete specifications on expansion joints to meet your needs are given in the new Flexon Expansion Joint Bulletin. Write for your copy today or see Flexonics Expansion Joint Catalogs in Sweet's, Chemical Engineering Catalog and The Refinery Catalog.

Flexonics *Corporation* **EXPANSION JOINT DIVISION**

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Flexon identifies CMH products that have served industry for over 50 years.

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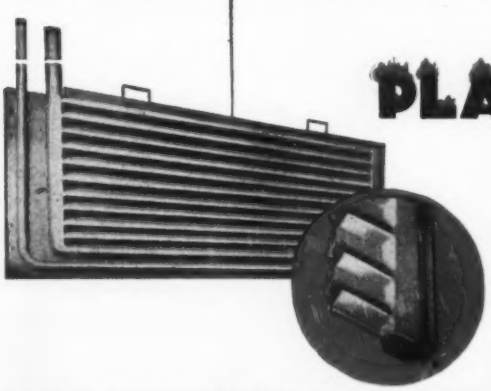
Here is a new treatment for solving your heat transfer problems that is as revolutionary as a new wonder drug. It stops coil-itis* cold . . . It eliminates the many troubles that have plagued industrial heating and cooling practices due to the use of old-fashioned, outmoded pipe coils. This revolutionary new unit, called a Platecoil, heats or cools 50% faster and takes 50% less space in the tank. It simplifies maintenance and saves hours of downtime.

Write for bulletin P79 today!

PLATECOILS SAVE 50% IN HEAT TRANSFER COSTS

PLATECOILS COOL QUENCH OIL TANK FOR ⅓ THE COST

At the K-D Manufacturing Company, Platecoils are proving more efficient, yet cost only 1/3 as much to install. Ask about other case histories.



PLATECOIL

REPLACES PIPE COILS

*

Coil-itis — Diagnosed as tank heating and cooling problems. Platecoils — the prescription for solving pipe coil problems.

PLATECOIL DIVISION, TRANTER MANUFACTURING, INC., LANSING 4, MICHIGAN

PLANT PERSONNEL

Continued from page 93

with insulation checks and voltage tests.

Maintenance Men. The mechanical-maintenance foreman and key men should study machinery instructions and assembly. They should be allowed to watch or help in equipment assembly. A final check of lubrication and alignment of all apparatus should be made before going into service. Prepare a schedule of lubrication points with frequency and type of lubricant. Lay in a complete stock of lubricants before starting the plant. Spare parts should be tagged and stocked in a clean, marked place. A stock of small tools, pipe fittings and shop materials should be assembled so maintenance work can start immediately. Make this stock inaccessible to construction-crew members.

Results Crew. The results engineer and his crew should test and adjust gages and thermometers before installation. Organize test equipment and supplies for water, flue gas, fuel and other work. Design the preliminary log sheets, and have 100 or so copies on hand for starting. Charts for all meters should be on hand. Meters, recorders, automatic controls should be tried out in place and adjusted in cooperation with manufacturers' representatives.

Shift Schedules. Schedules of working hours and shift rotations should be worked out after the men have had a chance to consider possible alternates and express their wishes. Change shifts at 8 am, 4 pm and midnight so calendar days are not split up. Also extra men will be available at chart-changing time for emergencies.

Start-up Overtime. For the first few weeks, much closer attendance is needed than during normal operations. Crews must learn many new things as each new machine goes into service and as new conditions develop with gradually increasing load. One and a half to two full crews are often kept on duty to handle this extra work. Operators should plan on considerable overtime for the first month or six weeks. Management should realize the overtime money is well spent for equipment protection and operator training.

Training New Men. All new employes, before being hired, should pass a satisfactory physical examination. Place them on a temporary or probationary classification for six months to a year before they become permanent employes. They should be carefully instructed on company policies, safety program, insurance and retirement benefits, sick leaves, absentee policies, etc. Tell them about the work they are to do, to whom they will report, location of their locker space, their working hours,

curious?

Furnace Operators! A little curiosity about this amazing FREE service can pay big dividends. *It's the Cities Service Heat Prover*. . . "not an instrument you buy, but a service we supply!" This unique instrument offers rapid, continuous sampling . . . simultaneous reading and direct measurement of oxygen and combustibles . . . and easy portability. We maintain the Heat Prover free of charge! It's not a curious fact that so many furnace operations have been bettered with the Heat Prover. Find out how and why the Heat Prover can increase furnace productivity for you. Call or write your nearest Cities Service Office or write Cities Service Oil Company, Dept. H16. Sixty Wall Tower, New York City 5, N. Y.

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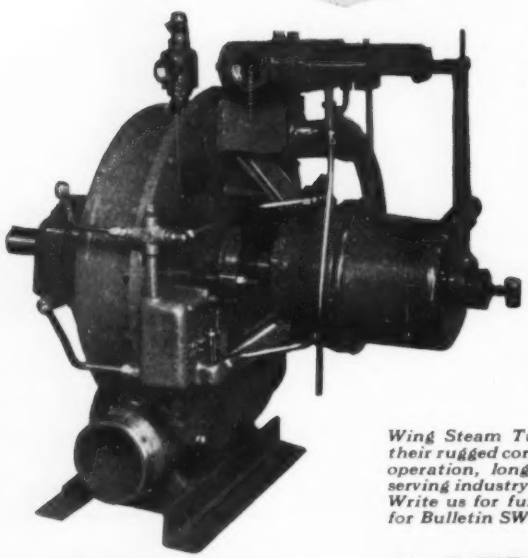
IF YOU USE STEAM FOR HEATING — COOKING OR PROCESSING —

You can get POWER at almost no cost!

Wing Steam Turbines cost little or nothing to operate where their oil-free exhaust steam can be used in process operations—or in space heating. The Turbine acts as a reducing valve . . . its exhaust steam has been reduced to the pressures used in heating and cooking operations. Wing Steam Turbines give an infinite range of speeds, easily controlled by throttling—and they are completely independent of any electric power failure.

WING STEAM TURBINES



Wing Turbines furnish smooth, dependable power for compressors, pumps, fans, blowers, winches, generators, mixers and similar equipment.

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Horsepowers to 150 b.h.p.

Temperatures to 750°F.
Pressures to 600 p.s.i.
Back Pressures to 50 lb.
Speeds to 4000 r.p.m.

Wing Steam Turbines are known for their rugged construction, trouble-free operation, long life. They have been serving industry for over a half-century. Write us for further information. Ask for Bulletin SW-1a.

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Factories: Linden, N. J. and Montreal, Can.

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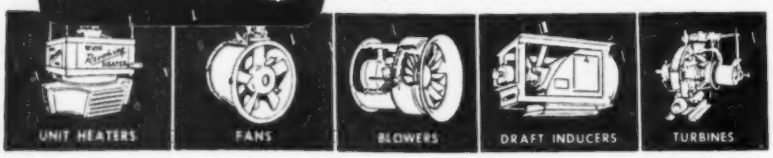


PLANT PERSONNEL

Continued from page 206

special precautions to take. After a short time inform them about possible lines of advancement and the policy on wage increases. Require strict observance of company rules, satisfactory performance of work and regular attendance. Equal treatment of all, which makes for fewer personnel troubles, may be aided by rules or standards for tardiness, lost-time allowance, vacations, sick leaves, etc.

More PLANT PROBLEMS

Continued from page 134

and dirt that accumulate on roof during dry seasons. Of course, a good gravel and sand filter would clean this water before it enters storage reservoir.

Underground concrete reservoirs are unsuitable for water storage because chemicals from concrete may enter boiler with rain water. In one plant I know of, condensate was collected in underground concrete tanks, carrying chemicals over to boiler. Tank had to be lined with monel sheets before the trouble was cured. I believe copper could be used in place of monel.

Use an overhead rain-water collection tank, and feed needed makeup to condensate return tank. Pump from here to deaerator.

L M Martinez *Rego Park, N. Y.*

THREE STEPS to solve this problem are: (1) Determine allowable or desirable boiler concentration. (2) Conduct enough tests until you have a representative sample of rain water. (3) Figure how much blowdown and feed treatment are needed. Once you know this, you can figure the cost of using rain water for boiler feed.

W H Halpenny *Riverside, Calif.*

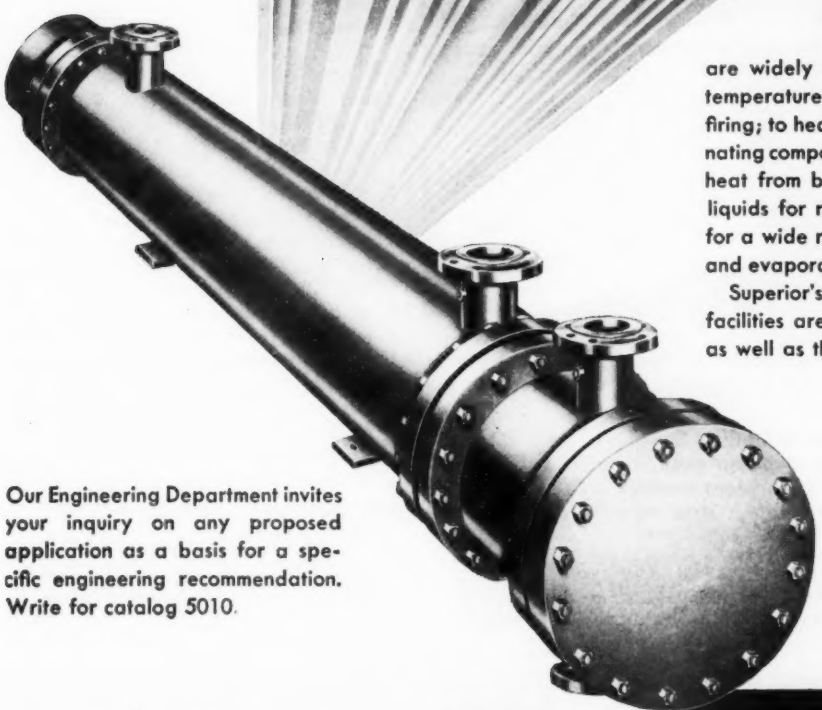
HAVE HEATER big enough to handle the gases present in rain water. Vent size will probably have to be increased. Use a good conditioner to neutralize the water, following manufacturer's instructions for correct use.

Have a sediment pit and drain valves in storage tank. Don't forget to have overflow outlets. Two or more storage tanks would be better than one because one could be cleaned while others are in service. Have enough storage capacity to handle at least the average rainfall in the area.

C G Howarter *Canton, Ill.*

DIRECT-ACTING steam pump is best for pumping rain water from reservoir to

HEATING
COOLING
CONDENSING
EVAPORATING



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are widely used to heat viscous liquids to flow temperature; to preheat fuel oil for more efficient firing; to heat boiler feed water; to heat impregnating compounds for better absorption; to recover heat from boiler blow-down; to heat gases and liquids for refinery and chemical processes; and for a wide range of heating, cooling, condensing, and evaporating applications.

Superior's complete design and manufacturing facilities are geared to handle the most unusual as well as the more conventional requirements.

Our Engineering Department invites your inquiry on any proposed application as a basis for a specific engineering recommendation. Write for catalog 5010.

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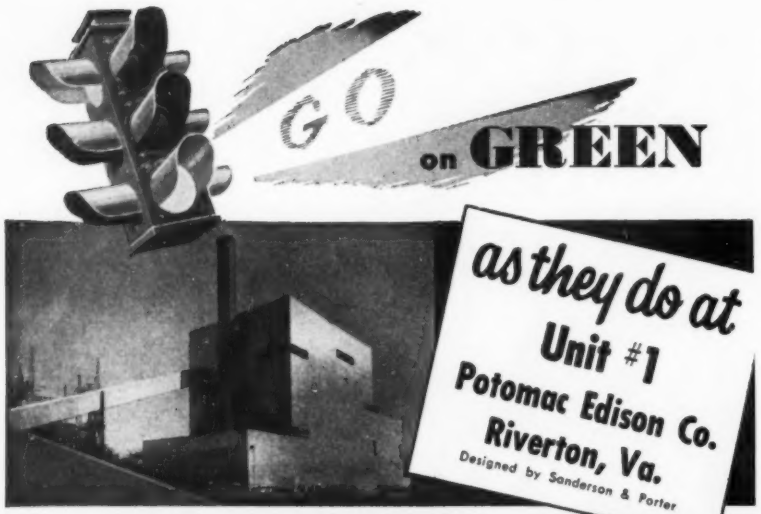
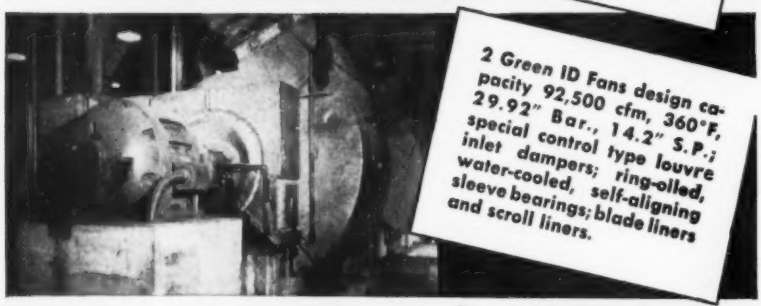
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

SUPERIOR
HEAT EXCHANGERS




2 Green ID Fans design capacity 92,500 cfm, 360°F, 29.92" Bar., 14.2" S.P.; special control type louvre inlet dampers; ring-oiled, water-cooled, self-aligning sleeve bearings; blade liners and scroll liners.

2 Green FD Fans design capacity 55,000 cfm, 100°F, 29.92" Bar., 12.4" S.P.; design 4 A inlet vanes; outlet dampers; inlet screens; ring-oiled, water-cooled, self-aligning sleeve bearings.

The list grows—the list of utility and industrial steam generating plants for which Green Fans were selected to provide the air necessary for combustion purposes.

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THE GREEN Fuel Economizer COMPANY INC.

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- Air Heaters
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- Aerodyne Dust Collectors

BEACON 3, NEW YORK

treatment tanks. Be sure to treat water carefully before using.

JOHN MURPHY *Quebec, Can.*

FIGURE AMOUNT of water that can be obtained from collecting rain. Then compare cost of an equal amount purchased from the local water company. With these figures on hand it should be easy to decide if rain-water collection is a sound proposition. We collect rain water in our plant and pipe drains from drinking fountains to the same reservoir.

Since dissolved gases are found in rain water, I flash this water in an open heater and then treat it. A siphon is used to move the water.

J P DEMAS SR *Roselle Park, N. J.*

MARMADUKE

Continued from page 142

he could drink any two Troedyhim villagers under the table—and walk back to the plant to do a day's work.

"But I learned that at one time he got so he spent as much time in the local pubs as he did around his plant. Finally, he couldn't pass a bar without stoping in to ballast his deeps with a few mugs of ale. And usually he'd stick around and top it all off with a gullet washer or two of Sandpaper Gin.

"Before long Jock was spending more time in the pubs than at his plant. That would have been all right but for one thing. The plant started breaking down. And it often happened while Jock was away having a snootful.

"The village fathers tried signing someone on to fill his berth several times, but no dice. Each time a prospective chief engineer saw the plant, he would throw up his hands and refuse the job. One reason was that things were in very sad shape. Everything seemed to leak fuel oil, lube oil or water. Another reason was that Jock had put in so many Rube Goldberg hookups and gadgets that nothing seemed to make sense. But he knew every valve and gadget so well he could find his way around in the dark.

"Jock took advantage of all this and got harder to get along with. Then he spent more and more time at the pubs.

"Just about the time the village fathers were fed up and ready to scuttle him regardless, he did a strange thing. He married Lizzy Logan, widow of the late chief engineer from the next village. The local citizens couldn't understand why a self-respecting woman like Lizzy would get spliced to a bar fly like Jock. But Lizzy was a stubborn girl and evidently had a few aces up her sleeve. It turned out that she knew something about power plants besides. Some Troedyhim people were hopeful, at long

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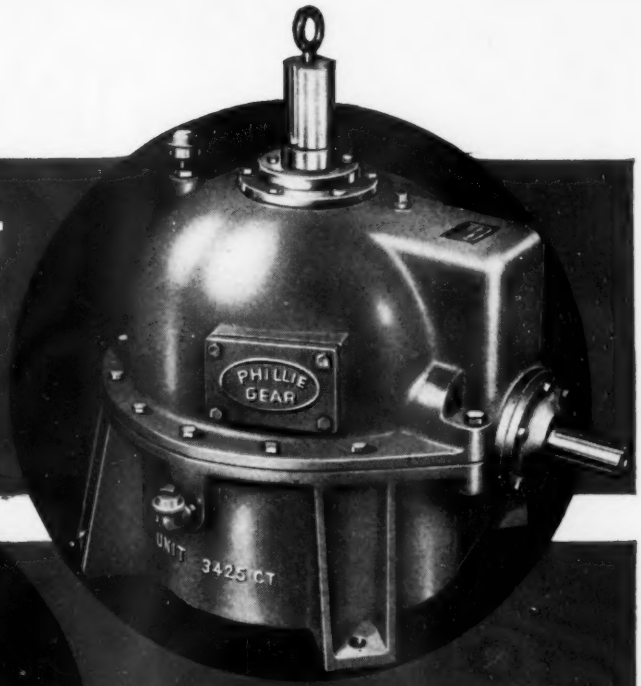

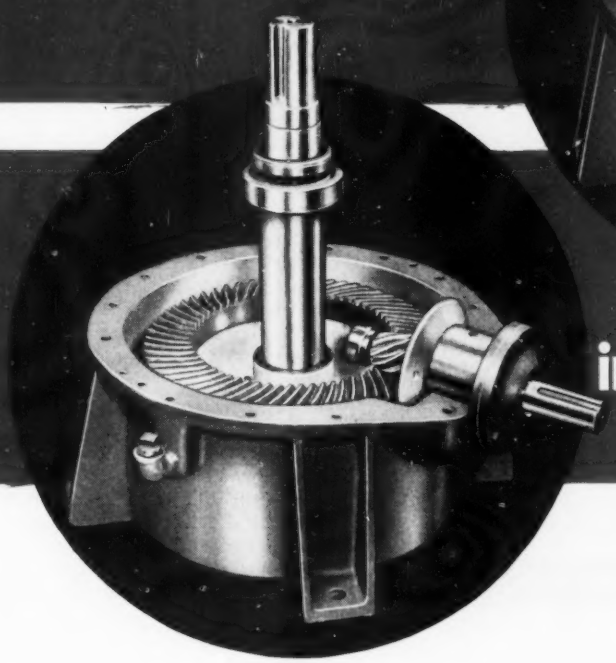

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SIMPLE
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EFFICIENT

Philadelphia Spiral-Bevel Cooling Tower Units are manufactured in five sizes, rated from 15 to 60 Horsepower at 1750 rpm motor speed.

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Literature upon request.

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This True Ball Joint Makes the Difference

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DART UNIONS

MARMADUKE

Continued from page 210

last, that she would straighten Jock out.

"But Jock evidently had no intention of changing his ways. His importance had gone to his head because there he was, shoving off for his usual rounds a few nights after being married.

"Lizzy gave him plenty of rope for a week or so—then she stepped aboard to take command of her matrimonial ship. It started one evening when Jock was down the street at the Green Lantern, ballasting his tanks. All of a sudden the lights went out. Jock hurried back to the plant. But the engine was running fine and everything seemed to be as he had left it, with one exception. The main switch serving the area of the Green Lantern was open.

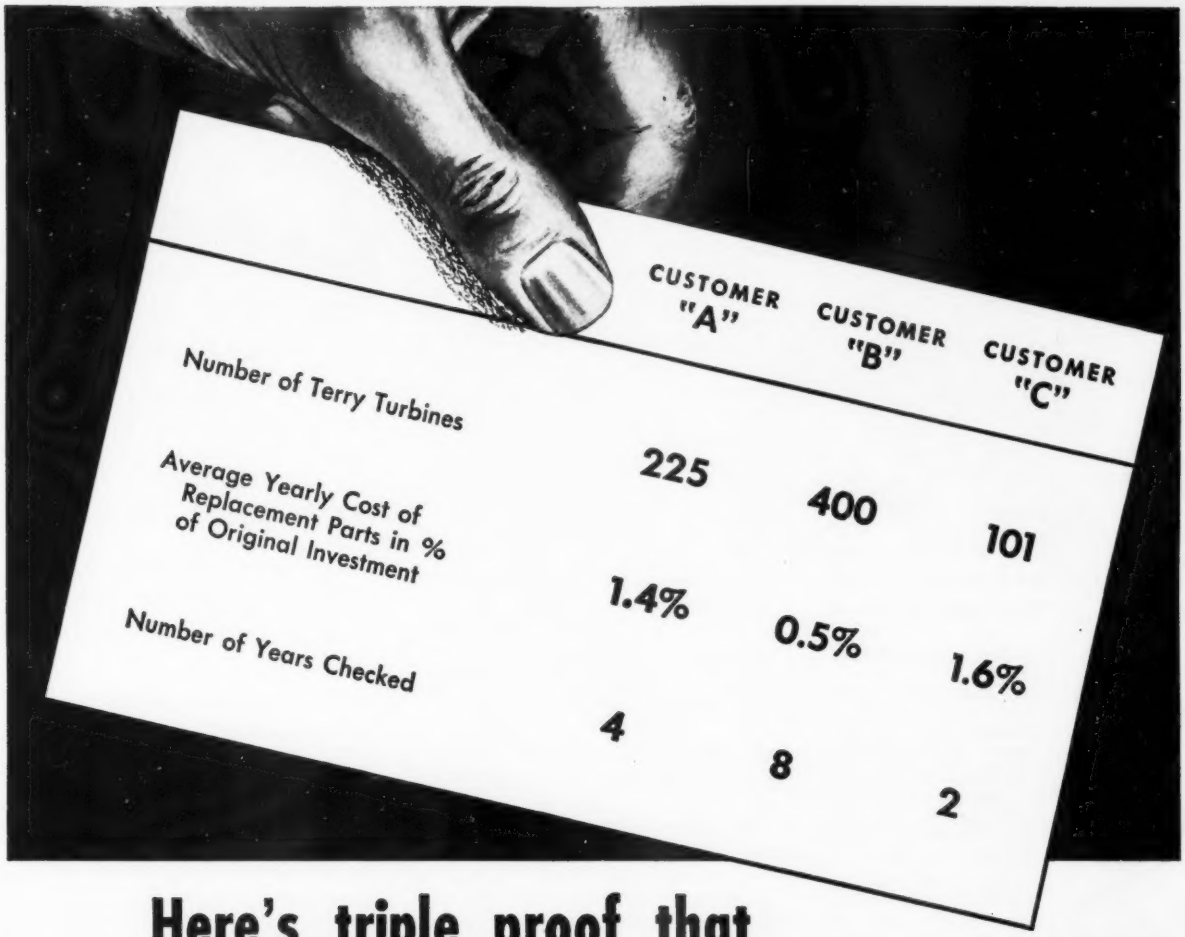
"Next evening when Jock went out for a little elbow bending at the Jolly Inn over near the slaughter house, the same thing happened. The third evening he was at the Silver Slipper when the lights went out. This time, Jock decided it was time to steer his own ship. Instead of charting a course to the plant, he tacked a few points north by northeast to the Barnstaple Tavern, where the lights were still on. He'd show Lizzy a thing or two. But just about the time he got a high vacuum on his ballast pump and was set for some fancy refueling, the lights gradually dimmed and blacked out. Jock got pink around the gills as his temperature hit the critical point and he popped his safeties besides. There was no mistake about it, the engine had stopped.

"This time, Dan Goodwill, the proprietor, and a half-dozen customers, who were anxious to resume their favorite sport of elbow bending, escorted Jock back to the power plant. The whole town was in darkness, and angry townspeople were already gathering at the plant to see what was wrong. As expected, Jock found the engine's throttle valve shut. He started things up in a hurry, with the help of a few choice cuss words he hadn't used in years.

"After that night, the village pub owners cooperated with Lizzy. They lost their star customer, but they couldn't help it.

"Finally, Jock had nothing else to do but take care of his plant again. So before long, his engines and plant were shipshape."

Marmy turned back to his bottle of Sandpaper Gin, roaring over his shoulder. "And Lizzy did it all, not by laying down the law to Jock, but by quietly leaving her kitchen and pulling a switch or by closing a throttle now and then. Maybe she didn't know how to handle the plant as well as Jock did, but she knew how to handle Jock. That made her skipper of THAT ship."



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IT PAYS TO SPECIFY TERRY TURBINES

When you combine the figures for these three customers — a total of 726 turbines — the average yearly cost of replacement parts works out to only 1.1% of the original investment. A truly remarkable record, even when you realize that they are Terry turbines.

But, the cost of replacement parts is only the beginning of the story. The real savings are in the labor costs and production losses which are reduced so drastically when you install Terry turbines.

Send for further information about these low-maintenance turbines. Bulletin S-116 describes the many advantages of the Terry solid-wheel turbine. For multistage turbines, ask for a copy of Bulletin S-146.

THE TERRY STEAM TURBINE CO.
TERRY SQUARE, HARTFORD 1, CONN.

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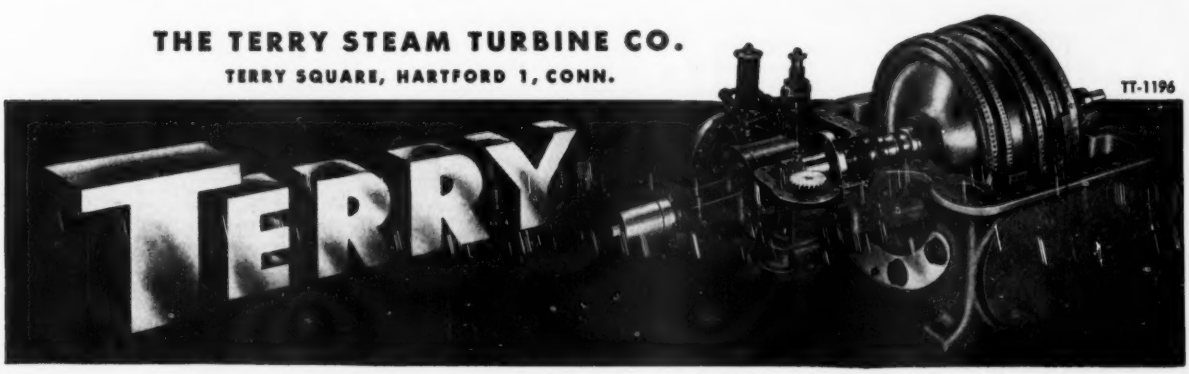
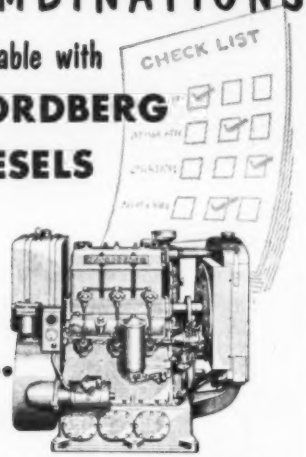


12 POWER COMBINATIONS

available with **NORDBERG DIESELS**



1 - 2 and 3-cylinder models for 4 types of service

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With 12 basic power combinations, Nordberg Diesel units offer you an extremely wide selection to help you get exactly the right kind of power to meet your specific requirements.

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4-453

More TECHNICAL BRIEFS

Begins on page 150

same total solids content as zeolite softening but containing substantially nothing but sodium chloride.

This process of treatment is considered to be particularly adaptable to the small power plant because it provides the advantage of both softening and alkalinity reduction at a lower investment cost than a hot process water softener without the need of maintaining proportional feeding devices, inlet level controls, vent condensers and spray heaters associated with the hot process water softener, without the use of acid or the requirement of blending devices, the need of breaking pressure to deaerate or the need of feeding caustic for pH control, one or more of which are associated with any other method of dealkalization following zeolite softening.

These advantages are weighed against the disadvantage of higher chemical costs and the disadvantage of no solids reduction as compared to hot process and split stream dealkalization methods. *APC Paper, no number.*

Acid Regeneration of Cation Exchangers. *By F K Lindsay, National Aluminate Corp.*

There are two factors that are largely responsible for the choice of acid to be used in any operation: (1) the availability of the acid under consideration and (2) the comparative cost of the acids for the particular installation involved. Sulfuric acid is most commonly used in large installations, for in most parts of the country it is more economical. Hydrochloric acid is generally selected for the smaller installations for its greater ease of application as well as for the higher exchange capacities that can usually be obtained.

In the application of sulfuric acid for the regeneration of high capacity cation exchange resins, the ratio of each individual cation to the total cations in the raw water is very important. If there is a large preponderance of calcium in the influent, there will be the same relative preponderance in the exhausted resin bed. Because of the much greater capacity of the current polystyrene resins as compared to the older, low capacity hydrogen exchangers, the possibility of encountering calcium sulfate precipitation during regeneration is therefore greatly increased. If, on the other hand, there is a high percentage of sodium in the raw water, the sodium will predominate in the exhausted bed and, if not thoroughly eliminated by the regeneration process, will result in sodium leakage during the operating cycle that follows.

(*Continued on page* 216)

PILOTLESS BOMBERS MADE WITH

FRICK

AIR CONDITIONING

The Glenn L. Martin Company, builders of "Matador" bombers, "404" transports, and other famous planes, uses 27 Frick compressors for air conditioning and special cooling services in its great plant at Middle River, Maryland. These machines have been installed over a period of 16 years by the Paul J. Vincent Co., Frick Distributors in Baltimore.

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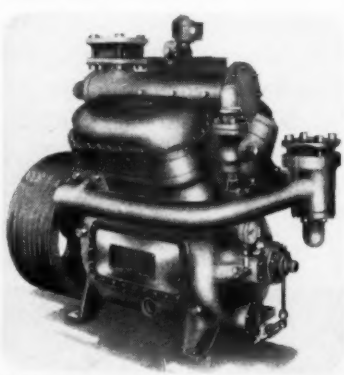

Frick "ECLIPSE" Compressors Handle Air Conditioning Work with Extra Economy: ask for details.

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Only Midwest "Long-Tangent" Elbows have these longer tangents (dotted lines indicate their length beyond ends of ASA Elbows). Tangents are ¼ of nominal diameter: a 12" elbow has tangents 3" long.

This young man's dad also saves money. But he does it by specifying Midwest LONG-TANGENT Elbows whenever he needs welded piping. These elbows (see above) can be lined up with pipe more quickly and accurately. Less pipe is required and a short nipple (with its extra circumferential weld) is frequently eliminated. Slip-on welding flanges are easily used with minimum change in either flange or fitting. And then . . . Midwest "Long-Tangent" Elbows cost no more than ASA Elbows. You, too, can save money by specifying them on your next welding fittings order.

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Davis Basket Type Strainers are used on pressure and suction pipe lines for the protection of meters, valves, pumps and other equipment. The No. 76 Strainer has a cylindrical basket with perforated sides and bottom supported at the top by a flange. When the cover is removed the basket may be lifted out easily for cleaning. Large body passage reduces pressure drop across the strainer to a minimum. The size of screen perforations depends on the fluid being strained and the foreign matter in suspension. Ask for recommendations.

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SIZES
½" to 14"

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This handy tool should be a "must" in your plant because it will help you meet emergencies. It provides the means of cutting your gaskets as you need them . . . immediately . . without loss of time or power . . . from any material such as felt, cork, rubber, compressed asbestos sheet, etc. up to 48" diameter.

Ask for a copy of the ALLPAX Catalog giving full details

In addition to Gasket Cutters, ALLPAX offers a complete line of Packings for all purposes. Special packings to order can be furnished promptly; also valve discs, retainer rings, molded and mandrel-cut packing rings and packing hooks. Send for complete information.

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Superheat Sheet Packing . . . Oil Proof Sheet Packing . . . Red Rubber Sheet Packing . . . Diaphragm Sheet Packing . . . Cloth Inserted Sheet Packing

More TECHNICAL BRIEFS

Begins on page 150

Cation leakage has generally been considered as the escape of a cation such as sodium, through the resin bed without being removed. This is actually incorrect, as the leakage of cations during the operation cycle is entirely due to the failure of completely eliminating the cations from the resin bed during the regeneration and rinsing operation. The exchange of hydrogen ions produced in the upper part of the bed with the ions left in the lower part of the bed causes the leakage. The degree of leakage is influenced by the anion content of the raw water.

By way of summary, data were presented that showed the importance of application techniques in the use of both sulfuric and hydrochloric acids as regenerants for cation exchange resins. Comparisons between sulfuric acid and hydrochloric acid have been given, illustrating the treated water quality and cation exchange capacity obtained with each. *APC Paper, no number.*

Feedwater Conditioning By Evaporation. *By A M Impagliazzo, Griscom-Russell Co.*

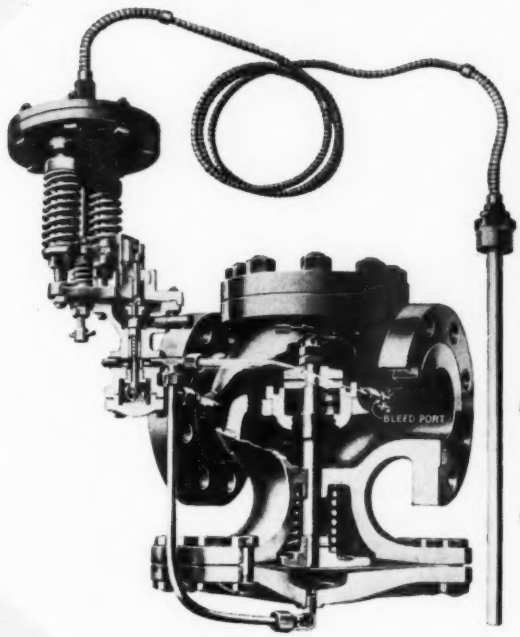
The use of evaporators for the production of boiler feed makeup in public utility power plants has been considered so necessary in the past that there have been few detailed studies of the total costs involved. From time to time there have been articles on the relative economy of one type of evaporator arrangement versus another, but since there were many common costs, these studies did not provide data on total costs.

In recent years the de-ionization processes have been developed to the point where they can produce makeup of quality approaching that of pure distillate. This has naturally led to considerable discussion regarding the relative costs of evaporation vs de-ionization.

As usual when comparing two totally dissimilar processes, true comparative costs are rather difficult to determine because the conditions under which reasonably close equivalence is achieved are not well established. It is inevitable that the relative importance attached to the various factors by one investigator will be questoned by another whose experience or reasoning has led him to a different conclusion. Indeed, it is probable that generalizations will prove impossible even when more data are available. An actual cost comparison was not attempted in this article. It was limited to a presentation of quantitative cost data for evaporators, and to questions which the user must answer before making comparisons in individual cases.

(*Continued on page* 218)

3 Reasons for Accurate Regulation



PACKLESS CONSTRUCTION

LARGE BALANCED METAL DIAPHRAGM

SENSITIVE PILOT

Spence

Packless construction eliminates the need for closely fitted parts that may stick or bind due to dirt or uneven expansion of the parts.

In Spence Temperature Regulators, the Main Valve is actuated by a large balanced metal diaphragm which responds to the slightest changes in temperature.

Sensitive Pilots are designed to limit heater pressure to an adjustable maximum. As the temperature at the thermostat drops a few degrees there is a corresponding increase in steam pressure up to the limit for which the Pilot is set.

With regulators that respond only to temperature, an increase in load is accompanied by a momentary decrease in steam pressure caused by faster condensation in the heating element. There is a time lag until the thermostat senses the temperature drop and opens the valve wider. Spence Temperature Regulators act like pilot operated pressure regulators when this occurs. They respond instantly to maintain the steam pressure until the thermostat has a chance to further increase it as needed for the heavier load.

These plus other design features explain why Spence Temperature Regulators function dependably and accurately year after year, without requiring extensive repairs or special attention.

Want more facts? Write for Bulletin T50 giving full details.

SPENCE ENGINEERING COMPANY, INC., Walden, New York

For DOUBLE BOILER BLOW-OFF SAFETY

These EVERLASTING Duplex Boiler Blow-Off Units are assuring double safety in plants all over the country.

In the unit illustrated above, the left-hand valve is the standard quick-operating EVERLASTING design which opens with a quarter-turn of the lever and closes with a drop-tight seal that actually improves with use. The right-hand valve is an EVERLASTING Angle Valve, stoutly built to withstand shocks and abrasion of blow-down solids.

Below are shown two additional EVERLASTING Duplex Units, each including the EVERLASTING "Y" Valve . . . simple and sturdy in design, with all parts interchangeable with those of the Angle Valve.

All EVERLASTING boiler blow-off designs conform with ASME codes, and are available in a range of sizes for pressures up to 600 psig.

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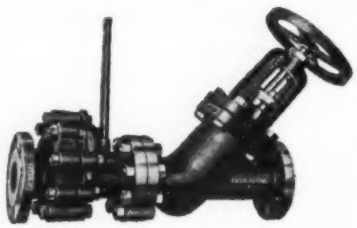
Two of the many available combinations of EVERLASTING Boiler Blow-Off Units



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More TECHNICAL BRIEFS

Begins on page 150

Boiler feed makeup with total dissolved solids guaranteed not to exceed 1 ppm can be produced by evaporation. The quality of the product is relatively unaffected by time or normal variations in raw water analysis. Added steam generating capacity and fuel requirements may be estimated for various evaporator arrangements. If the extraction feed water heaters in the base plant are not equipped with sub-cooling zones, added fuel costs and extra steam generating capacity can be greatly reduced and sometimes eliminated entirely by cascading the drips. Installed costs for evaporators and associated equipment can be approximated, and space requirements as well from equations the author gives.

Single effect evaporators without separate condensers, are most commonly used, but estimates of total costs indicate that when placed between the 2nd and 3rd extraction points, single effect evaporators with their own condensers, are more economical. Examination of equations shows that the use of separate condensers results in even greater savings when the evaporator is placed in a lower pressure part of the cycle.

Two effect evaporators result in the highest annual cost in central station plants of 60,000 kw capacity, but they may be justified because suitably arranged they can operate in double effect for normal requirements at a maximum fuel economy, and in single effect for extra capacity.

Evaporators may be associated with the turbine cycle in a number of different ways. It is necessary, therefore, to determine which is the most economical in a given case before a reasonable comparison with other methods of water conditioning can be made. The author feels that it is impossible to draw any general conclusions regarding the relative costs of evaporation and demineralization from the data now available. For the present, and for some time to come, it will be necessary to analyze each case individually making every effort to place the two processes on as equal a basis as possible and to evaluate the remaining differences. Cost comparisons which ignore differences in life expectancy, space requirements, necessary pre-treatment, guaranteed quality of the product and similar considerations are not reliable. *APC Paper, no number.*

Economics. Key to Evaporation vs Demineralization. *By E B Morris and C E Brune, American Gas and Electric Service Corp.*

With the trend in the industry toward higher efficiency cycles to combat rising costs, each contributory item in the over-

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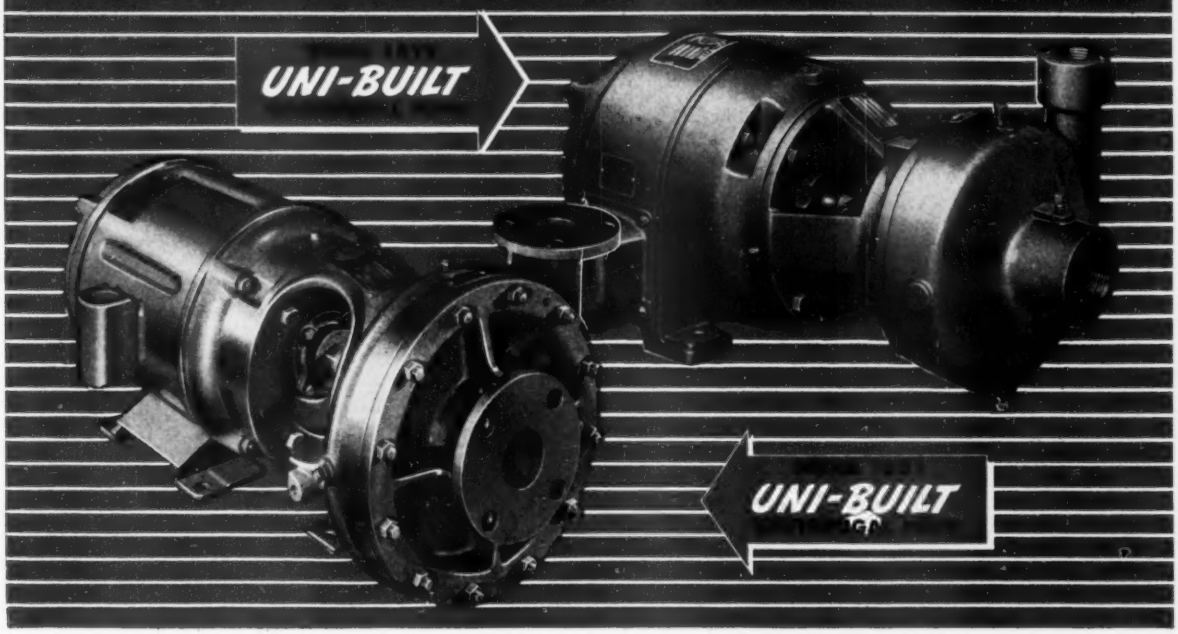

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Oversize bearings hold the shaft in alignment for smooth, quiet performance . . . balancing of the impeller prevents shaft vibration and seal failure. All parts are machined to rigid specifications, carefully inspected and assembled—assurance of minimum installation and maintenance expense. B & G Series 1522 and 1531 Pumps kept in stock at the factory are bronze-fitted only, but are available as all-iron, all-bronze or stainless steel units.

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Canadian Licensee: S. A. Armstrong Ltd., 1400 O'Connor Drive, Toronto, Canada

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REGARDLESS OF THE SIZE AND TYPE OF YOUR MACHINERY, LUBRIPLATE LUBRICANTS WILL IMPROVE ITS OPERATION AND REDUCE MAINTENANCE COSTS.

More TECHNICAL BRIEFS

Begins on page 150

all cost picture must be examined critically on an economic basis, and decisions must be governed largely by such results. Present day cycles tend toward higher operating pressures and temperatures, some around 2000 psi and 1050 F, and with low makeup requirements, frequently 1% or less.

Some published material dealing generally with the process of demineralization have led the authors to a general observation that, in many instances, a greater importance appears to be given to some factors than is warranted. For example, a study may show a distinct advantage for demineralization by employing a water having a composition particularly well suited for this process. Or, a detailed study of demineralization chemical operating costs may entirely ignore other cost factors which dollarwise may have even greater significance. Likewise, a general impression appears to exist that the intangible merits of the demineralization process should be a major deciding factor.

Where the design engineer is confronted with a new h-p unit installation or new plant, his decision as to makeup production by evaporation or demineralization should be based fundamentally on the economics. The intangible merits and disadvantages of each process should be recognized as such and their effect on guiding a decision be placed in proper perspective.

This paper attempts to classify and define the basic economic factors and to show their relative importance, by employing a specific case as an example. All discussions have two basic premises:

1. That the effluent of a demineralizer and the vapor from an evaporator are of equal purity or the difference is so slight that no significant effect on makeup requirements due to boiler blowdown is evident.

2. That straight-forward two-bed or single-bed demineralization will be employed without the complication of modified arrangements that may be desirable with certain waters to achieve desired results.

Without acceptance of these basic considerations as well, as others the authors bring out later, any economic study for a projected plant could become so involved with minor considerations as to make a reasonable comparison difficult. Once the economics of the study direct the engineer to a decision, the required details of minor financial significance may then be developed without their obscuring the main picture.

A stepwise economic study covering a specific case has been presented to

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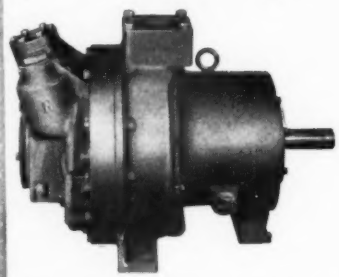

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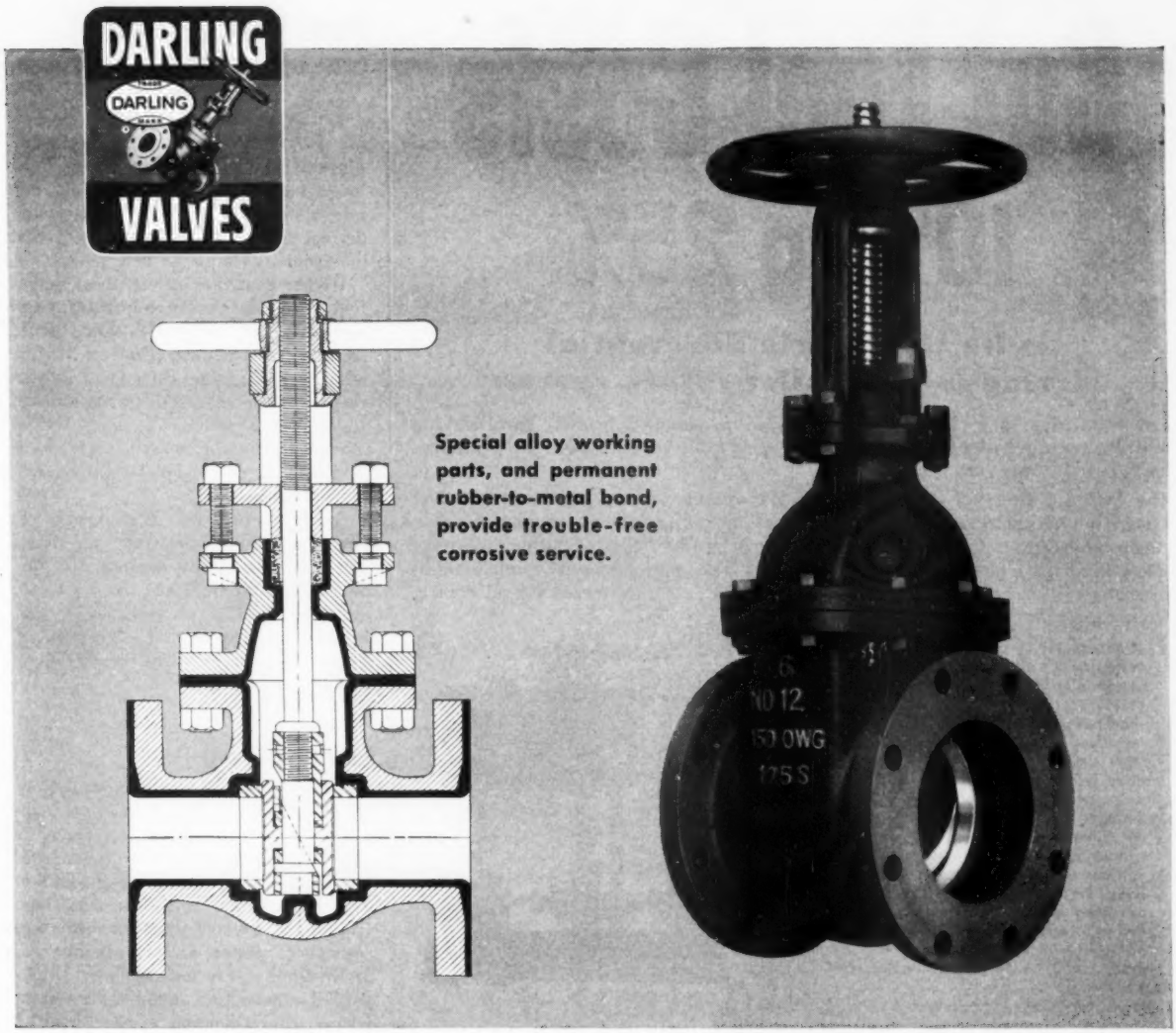

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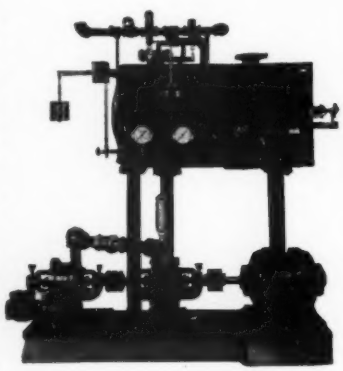
The Stickle differential drainage and boiler return system is a closed pumping system for returning condensation from heating and processing equipment under pressure directly to the boiler. Condensate reaches the boiler at a temperature of 300 degrees or higher—only 15 to 20 degrees lower than temperature of steam at operating pressure—thus saving steam and fuel . . . and increasing efficiency. Users report that the system. . . .



1. Reduces fuel costs 10% to 25% by completely salvaging condensate and returning it under pressure directly to boiler at 300 degrees temperature or higher—only 15 to 20 degrees less than temperature of steam at operating pressure.
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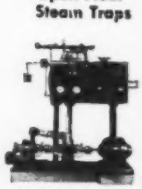


Differential Drainage and Boiler Return Systems

More TECHNICAL BRIEFS

Begins on page 150

demonstrate the line of reasoning that the authors are convinced must be employed. Although the economics of the lower makeup examples does not dictate a choice, this in no way should detract from the primary concept that the economics must be determined.

Higher heat rate differentials, higher fuel costs, lower makeup quantities and raw waters of lower total solids would seem to favor demineralization. On the other hand high fuel costs favor also an evaporator condenser, the installation of which goes a long way toward eliminating heat rate differentials in favor of demineralization. Fuel costs then fade in importance.

On the premise that economics is the key to selection of the makeup process, it is vital that all the significant factors be evaluated. Similarly, those factors unimportant to the overall balance must be avoided so that reasoning may be more readily directed to the objective. *APC Paper, no number.*

Electrical Insulation

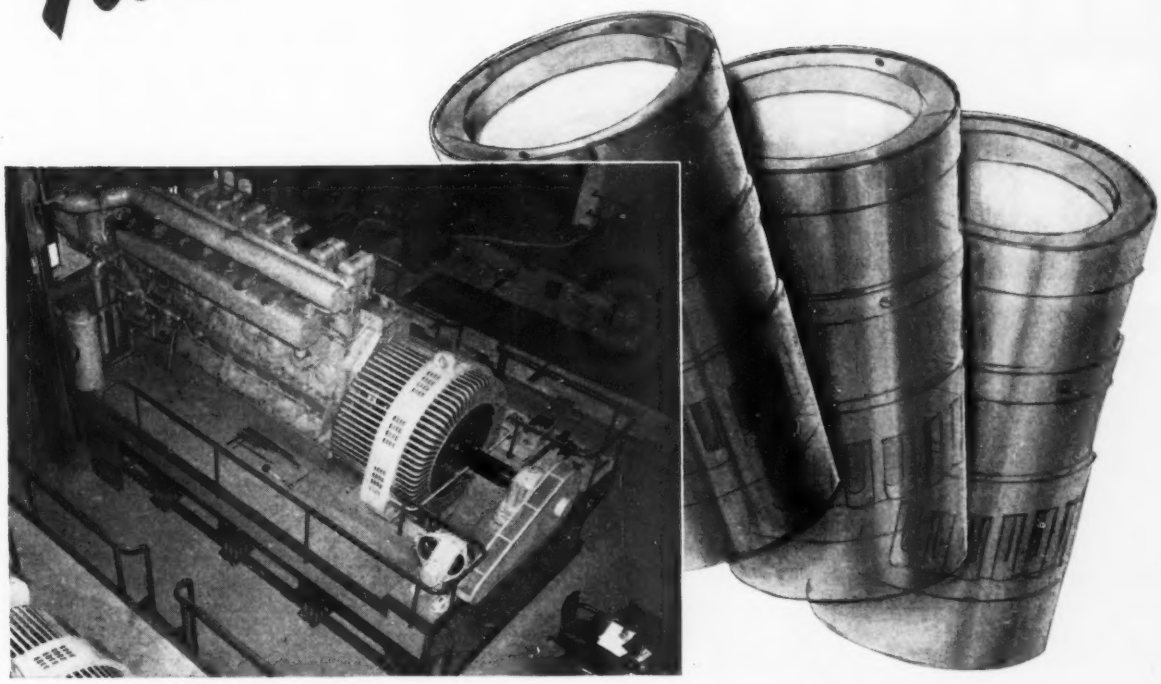
Non-Destructive Testing of Insulation. *By E L Brancato, Naval Research Lab.*

The user of electrical apparatus is constantly in need of information concerning the condition of the insulation. This information, at the present time, is supplied by such tests as insulation resistance, power factor, capacitance, or by more severe tests such as "high-pot." Unfortunately, none of these tests give a true indication of the "health" of the dielectric but rather indicate its present condition—a condition that may exist only temporarily and can be corrected by suitable action. It is, of course, important to have this information; however, it is of equal importance in many applications to have an indication of the useful life that can be expected from the dielectric at any time during its use.

The user, as well as the designer, of electrical apparatus can predict the minimum useful life of the insulation in such equipment when operated under an assumed set of conditions by referring to appropriate thermal aging curves for the insulation. However, after the equipment has been in operation for a period of time, the past operation will influence the future life and these thermal aging curves are no longer useful. It becomes necessary then to be able to measure some property of the dielectric that is related to this thermal aging process and which takes into consideration the deterioration.

(Continued on page 224)

Full-Throttle Profit...



Want to open the throttle for more profit? Then throttle back on Diesel operating costs — by using Van der Horst processing.

It gives you a flexible advantage. With VANDERLOY M, we renew worn liners — even those that oversize 0.001-inch per inch of diameter. Finished to original dimensions with PORUS-KROME*, they'll take twice the punishment raw liners can stand.

Yet, as compared to buying new ones, these Van der Horst liners save you money!

Use them to boost the power factor without increase in cost, or take the profit on their higher efficiency and much longer service life — whichever way fits best in your operating pattern.

Diesel owners everywhere find PORUS-KROME out-wears two or more raw liners. Rings stand up proportionately longer, against this unique plated service. And both fuel and lube oil consumption are reduced.

You might as well have this advantage. Cut out the cumulative cost of oversizing and use only standard size parts. Once you've tried it, you'll find Van der Horst processing is the way to full-throttle profit. We'd like to show you, in actual figures.

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* *PORUS-KROME is a dense, hard, wear and corrosion-resistant chromium, produced by the Van der Horst Corporation of America, and which gives working surfaces an infinite number of tiny oil-retaining reservoirs for perfected lubrication.*

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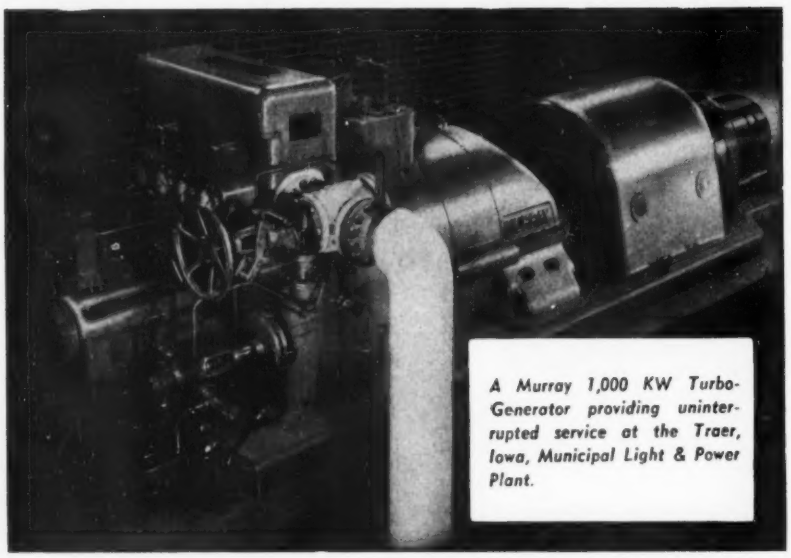

A Murray 1,000 KW Turbo-Generator providing uninterrupted service at the Traer, Iowa, Municipal Light & Power Plant.

● A typical, modern, small public utility is the Municipal Light and Power Plant at Traer, Iowa. This plant supplies water, steam heat and electric power to the community and surrounding countryside. The Murray turbo-generator pictured above carries the full electrical load of the plant and supplies the steam for heating by automatic extraction at 10# gauge pressure.

The simplified design and rugged construction of this and all MURRAY turbines particularly adapt them to this or any other drive where long life, reliability and low operating costs are a *must*.

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More TECHNICAL BRIEFS

Begins on page 150

The dielectric properties of insulation undergo a change during thermal aging. This is particularly evident in the dielectric loss and in the insulation resistance. The variations in these values during aging tests can be correlated with the mechanical properties of the materials making it possible to establish the time at which the plasticizer has been removed and embrittlement exists. This point of embrittlement correlates with minimum point on the normal life temperature curves for Formex insulation, a special type tested by the author.

The usefulness of these changes in dielectric properties during thermal aging in determining the true picture of life remaining in insulation can be determined only through further studies of other insulations with dipolar as well as those with non-polar groups. An investigation of the effects of environment and conditions of contamination is also in order. It is important that studies be made of the change in properties of insulated structures which are composed of two or more dielectrics, as is found in machinery construction. It is expected, too, that further work will reveal the effects of temperature cycling on these dielectric properties; this is desirable information at the higher temperatures. *AIEE Paper No. 53-125.*

ELECTRIC CONTROLS

Operatorless Elevators. *By Sidney J Clark, Otis Elevator Co.*

For many years, light-duty elevators have been operated without attendants, therefore being automatic might be classed as operatorless. But, let us think of the latter as the units of a group of three or more heavy duty continuously-running non-attended high-speed elevators, controlled by an automatic group supervisory system that automatically handles six different traffic programs. These programs are: up-peak, balanced up - down, heavier - down, heavier - up, down-peak, intermittent night and holiday traffic.

On operatorless elevators the dispatching system is used directly to initiate starting the cars instead of working through starters or other attendants. A load-weighing device is also used to: (1) dispatch cars from the ground floor when 80% loaded if this occurs before the scheduled time interval has elapsed, (2) bypass all halt calls if the car is loaded to 80% of capacity. To prevent passengers being hit by closing hoistway and car doors, closing speed of these doors has been reduced and a protective device is used that returns the doors to open position if a passenger is in their way. A two-way loudspeaker

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First, determine all possible conditions of the liquid to be pumped—chemical analysis, suction lift (if any), head or pressure, specific gravity and temperature of liquid—then pick the exact pump made for those conditions. (In the "Buffalo" line, you'll *find* that "ideal" pump, because the line is so complete.)

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The higher the speed, the more the pump will deliver—within reason—and the smaller the pump you can use for a given job. But be sure to operate at no higher than recommended speeds. Overspeeding wears out any pump.

3. RIGHT INSTALLATION AIDS PERFORMANCE

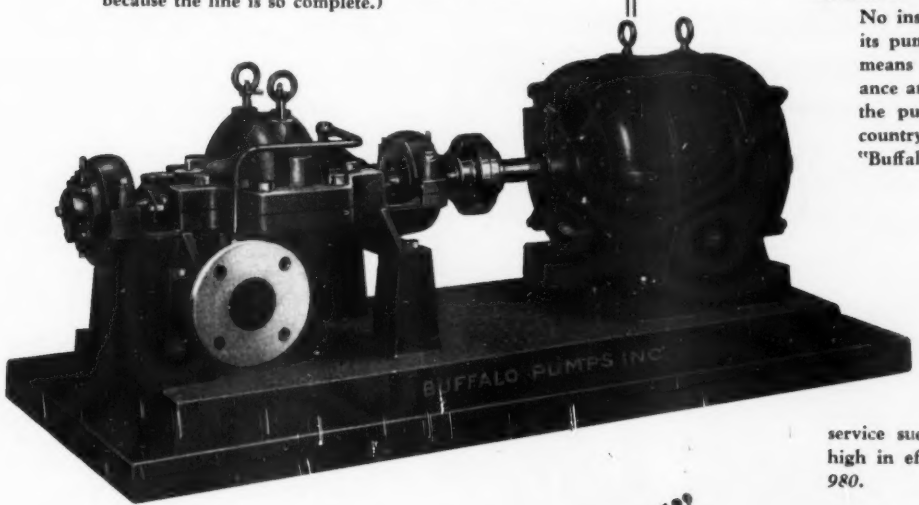
Give your pump the best chance—install close as possible to liquid supply source—keep pipe friction losses to a minimum—be sure suction line has no humps or hollows which could cause air locks. (You'll find "Buffalo" Pumps compactly built and easy to install.)

4. REGULAR MAINTENANCE SCHEDULE LENGTHENS PUMP LIFE

Regular inspections and servicing of bearing lubrication, shaft alignment, packing, impeller not only keep your pumps running smoothly, but head off minor conditions which could develop into problems later on. (You have a long-life "bonus" to start with if your pumps are "Buffalo"!)

5. A QUALITY PUMP IS ALWAYS AN ECONOMY —SPECIFY "BUFFALO"

No installation can be better than its pump. For known quality that means long life, efficient performance and simple maintenance, pick the pumps used in many of the country's largest installations—"Buffalo" Pumps.



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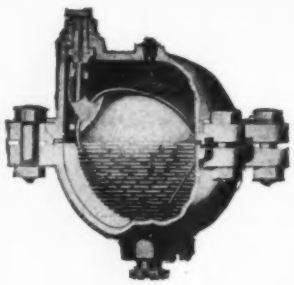
GET RID OF AIR ACCUMULATIONS IN PIPE LINES...



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When air lodges at high spots in pipe lines, it reduces the effective area of the pipe, creates a friction head, lowers pumping capacity, and may result in serious water hammer!

Simplex Air Release Valves bring you a sure, efficient cure for these difficulties . . . venting air *automatically before it can cause damage.*

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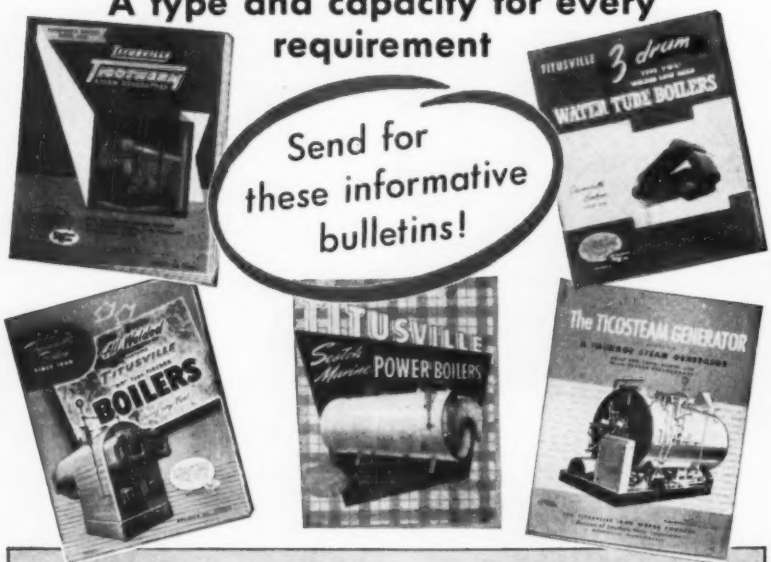

THE TITUSVILLE IRON WORKS COMPANY
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More TECHNICAL BRIEFS

Begins on page 150

system is installed between each car and the starter's station to complete the operatorless elevator system.

Many of these elevators are in operation in new and modernized buildings giving reliable and safe service and current negotiations for elevators in major buildings almost invariably include consideration of the operatorless type. In general these elevators with door reversal devices cost about 8 to 10% more than the same bank arranged to operate with attendants. Total annual cost of attendants per elevator will vary with different buildings, but will range from about $5500 to $8000 per year. *AIEE conference paper, no number, can be obtained from the author.*

Problem to Consider in Applying Selenium Rectifiers. *By J Gramels, Bell Telephone Laboratories.*

Proper selection of selenium rectifiers stacks for dc power supply in large industrial projects involve several important considerations. Carefully analyze circuit requirements so that allowances may be made for variations in the voltage-current characteristics of each rectifier-manufacturer's product as well as those found in stacks of the same rating of different manufacturers.

Equipment engineers must anticipate the differences in mechanical details of stacks of the same rating assembled by different suppliers. Unfortunately there are no standards in the selenium-cell-industry as to details of overall length, height of stacks and type of mountings.

Take into account the change in voltage-current characteristics of the rectifiers over the temperature range through which they must operate. At very low temperatures output voltage may be 5 to 10% less than at normal room temperatures. For high-temperature operation, stack-current and voltage ratings must be reduced to prevent overheating and rapid failure.

Unless otherwise specified, rectifier stacks are coated with paint and varnish to protect them against moisture in normal humidity. Where rectifiers may be exposed to high humidity, fungus, salt or other corrosive atmospheres, stacks must be given a protective coating.

Output of selenium cells decrease with age. If the rectifier load requires constant voltage, increased ac voltage must be supplied to the rectifier as it ages. The engineer should also take into account what life he expects of the application. For telephone and elevator work selenium rectifier should be selected for a life of 10 to 20 years or more. *AIEE conference paper, no number, can be obtained from the author.*

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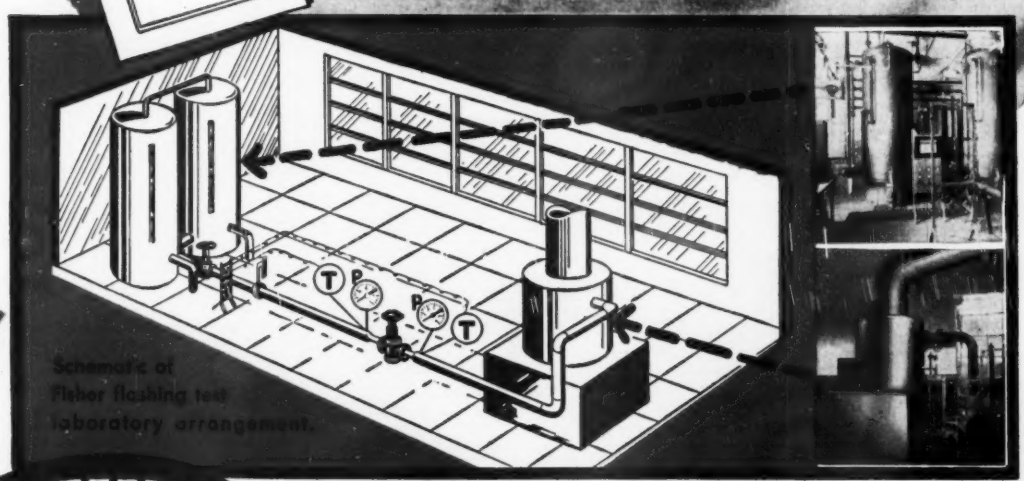

Schematic of Fisher flashing test laboratory arrangement.

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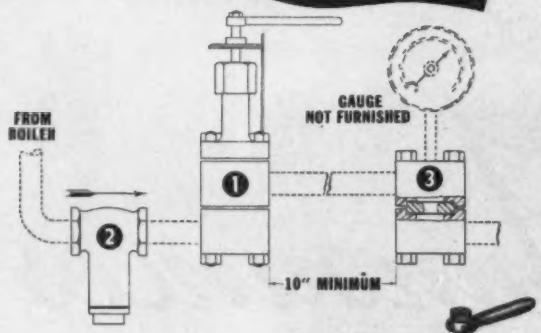
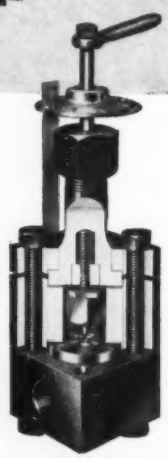
Custom-Built... CONTINUOUS BLOWDOWN





Also available in outside screw and yoke.

STRONG Dual-Orifice Assembly gives Greater Accuracy . . . Rugged Service!

Strong's Continuous Boiler Blowdown Assembly includes a Strong *block steel* Evrtyte* Valve (1), a strainer (2) and an orifice block (3), *custom-built* and accurately sized for *your own job conditions.*

The assembly is essentially two orifices arranged in series. The first orifice (valve) is variable . . . . the second is fixed. Correct proportioning of orifices provides extremely accurate control and reduces wire drawing.

Strong Evrtyte steel valves have special Anum-Metl X seats and discs of 750 Brinell surface hardness for long life. Available for pressures to 1500 psi and temperatures to 800° F. or 6000 psi non-shock cold service.

Let us custom-size your continuous blowdown system. Send for Catalog No. 68-I and our Continuous Blowdown Check-Chart today!

*Reg. Trade Mark

STRONG, CARLISLE & HAMMOND COMPANY

1392 West 3rd Street
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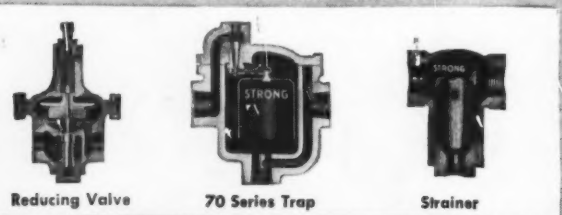
ANUM-METL Reg. Trade Mark

OTHER STRONG STEAM SPECIALTIES



Reducing Valve | 70 Series Trap | Strainer

STRONG

More FREE BULLETINS

Begins on page 163

14 **Caterpillar cable controls,** both rear and front-mounted, covered in 8-page booklet. Cutaway and model views show advantages of No 24 front-mounted unit and No 21, No. 25, No 27 rear-mounted controls. Form 30598. Caterpillar Tractor Co, Peoria, Ill.

ELECTRICAL EQUIPMENT

15 **Protective relaying** of power apparatus presented in 72-page booklet. Discusses types of relays for protecting generators, transformers, transmission lines, etc. Bulletin GET-1768A. General Electric Co, Schenectady 5, N. Y.

16 **Electronic adjustable-speed** drives from ¾ to 3 hp described in 12-page bulletin. Photos, tables, graphs cover hp-ratings, torque characteristics and other specs. Bulletin D-2102. Reliance Electric & Engrg Co, 1088 Ivanhoe Rd, Cleveland 10, Ohio.

17 **Circuit breakers** and their advantages over fused devices explained in 8-page booklet. Discusses design and operating details, applications for seven types of enclosures. Booklet B05456. Photos and selection data charts. Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

18 **Corrosion-resistant cable** discussed in booklet titled *Wire and Cable for the Chemical Industries.* Spec data, photos and installation illustrations incl. Booklet 19-312. General Electric Co, Bridgeport 2, Conn.

★ **Magnetic amplifier** regulated power supplies for laboratory testing applications covered in 8-page bulletin. Describes high and low-voltage power supplies with regulations down to .15%. Bulletin L453. ★Request direct on company letterhead to Perkin Engrg Corp, 345 Kansas St, El Segundo, Calif.

19 **Wound rotor motors,** ½ to 1000 hp, described with operation principles, performance curves, etc. Bulletin 1300. Louis Allis Co, Milwaukee 7, Wis.

20 **Specialty transformers** discussed in 18-page booklet. Covers details of specialty transformers built from available components or completely tailor-made. Booklet B-5806. Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

21 **Cooling system** of forced-oil-air-cooled power transformers explained in 2-color, 4-page, illustrated bulletin. Discusses unit coolers, directed flow, cooling efficiency, flow selector and control. Bulletin GEA 5969. General Electric Co, Schenectady 5, N. Y.

22 **Electrodes** of stainless, mild and high-tensile steels, cast iron, nonferrous, low hydrogen, hardfacing described in 50-page, illustrated pocket guide. Form ADC 650. Air Reduction Sales Co, 60 E 42nd St, New York 17, N.Y.

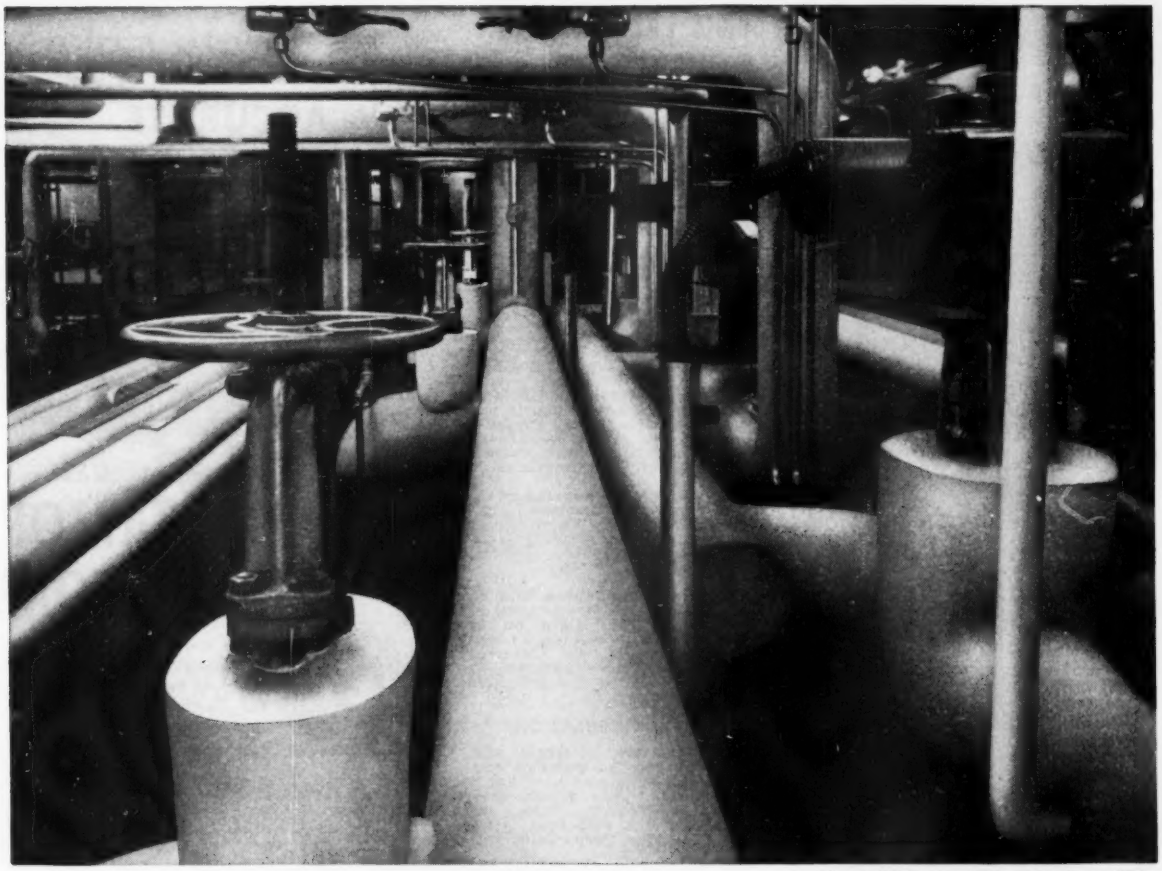
23 **Motor generators,** ¾ to 1500 kw, covered in 6-page bulletin. Presents electrical specs and applications of 23 designs. Bulletin 30-200. Electric Products Co, 1725 Clarkstone Rd, Cleveland 12, Ohio

24 **New NEMA motor standards** presented in 8-page, 2-color bulletin. Passed by NEMA on May 19, standards set up new frame dimensions for ac motors from 1 to 30 hp. Bulletin GEA-5995. General Electric Co, Schenectady 5, N. Y.

25 **Demand metering** and the theory, economics, operation and application of demand meters presented in 48-page, illustrated manual. General Electric Co, Schenectady 5, N. Y.

26 **Motor selection** for ordinary applications of polyphase squirrel-cage induction motors explained in 10-page, 2-color catalog. Presents electrical and mechanical modifications available for particular installation needs. Brochure 100. General Dynamics Corp, Electro Dynamic Div, Bayonne, N. J.

27 **Low-voltage capacitors** for power factor correction discussed in 27-



View of Pipe bay in large eastern utility plant, showing pipes insulated with K&M "Featherweight" 85% Magnesia.

FOR ECONOMY'S SAKE

Insulate with "Featherweight" 85% MAGNESIA

Save heat and you save money. Thousands of plants depend upon "Featherweight" 85% Magnesia to do just that. And no wonder!

"Featherweight" needs no introduction to thousands of users, many of whom first experienced its unusual qualities before this century began.

It is a superb insulation, low in thermal conductivity and not only effective on heated surfaces with temperatures up to 600° F., but when used in combination with K&M Hy-Temp Insulation, it is efficient up to 1900° F. This combination of double layers permits staggering all joints and eliminating heat loss through open joints when expansion occurs.

Keep this heat-saving, money-saving insulation in mind for applications in *your* company's plants. It will serve you well—always! For detailed information on "Featherweight" 85% Magnesia, see your local K&M distributor, who is an experienced applicator, or write directly to us.

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Keasbey & Mattison has made it serve mankind since 1873

KEASBEY & MATTISON
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In Canada: ATLAS ASBESTOS COMPANY, LTD., MONTREAL, TORONTO, WINNIPEG, and VANCOUVER

TWO STAGE—DOUBLE REDUCTION

Crusher is pictured without hopper and sprocker guards, but is delivered complete.

WRITE TODAY FOR CRUSHER BULLETIN P-3

T. J. GUNDLACH Machine Co., Belleville, Ill.

All Gundlach Crushers are equipped with Gundlach Patented Crushing rollers. (Pat. No. 2578540)

MATERIAL SIZE CAN BE CHANGED WHILE MACHINE IS RUNNING

Fulfilling an urgent need in the industry, the GUNDLACH "Two Stage" Crusher has delivered over 85% usable stoker coal from an Illinois mine run lot.

Two Stage CRUSHING IN ONE MACHINE!

The GUNDLACH "Two Stage" Coal Crusher incorporates two crushing stages in one machine and is designed to reduce RUN-OF-MINE to STOKER COAL in ONE operation. Compact design simplifies structural supports and installation. Rugged simple construction combined with engineering proved in the field makes this machine a profitable and reliable unit.

More FREE BULLETINS

Begins on page 163

page, 2-color catalog. Installation diagrams and specs incl. Catalog 50B. Sprague Electric Co, N Adams, Mass.

HEAT EXCHANGERS

28 **Steam atomizing oil burners** for use with heavy oil or tar in boilers, stills, dryers and other furnaces having steam or compressed air available for atomizing the oil. 15-page bulletin 21. National Airoil Burner Co, Inc, 1284 E Sedgley Ave, Philadelphia 34, Pa.

29 **Immersion heater** catalog features data for calculating power requirements for heating processing tanks. 2-page folder with photos, spec tables, graphs. Cleveland Process Co, 7016 Euclid Ave, Cleveland 3, Ohio.

30 **Gas and dual-fuel firing** for heating and power plants explained in 4-page, 3-color folder. Presents vertical, "inshot" and ring type burners and new dual-fuel package unit. Form 2359. Iron Fireman Mfg Co, Cleveland 11, Ohio.

31 **Oil and gas burning** equipment for foundries discussed in 28-page, 2-color catalog. Photos, spec charts, firing diagrams. Catalog 1043C. Hauck Mfg Co, 124-136 10th St, Brooklyn 15, N. Y.

32 **Heat exchangers** and hot water storage heaters covered in 16-page, 2-color catalog. Data on horizontal, vertical and instantaneous heaters, convertors, coolers, etc. Cutaway photos, spec tables and diagrams. Catalog 5. Patterson-Kelley Co, Inc, Warren St, E Stroudsburg, Pa.

INSULATION

33 **Insulation** of rigid and flexible *Fiberglas* for exterior and interior lining of warm and cold air ducts discussed in 16-page design data booklet. Photos, efficiency data, installation sketches. AIA File 30-A. Owens-Corning Fiberglas Corp, Toledo 1, Ohio.

34 **Thermoplastic insulating** material explained in 2-color tech bulletin 1-3-53. Spec tables and graphs cover physical, electrical, chemical, mechanical properties. M W Kellogg Co, PO Box 469, Jersey City 3, N. J.

35 **Vibration isolation** between connecting suction and discharge lines and air conditioning machinery, pumps and turbines explained in 2-color leaflet. Specs, inst instr, supporting data on Flexon *Vibra-Sorbers*. Bulletin V/S. Flexonics Corp, Maywood, Ill.

MAINTENANCE, SAFETY EQUIPMENT

36 **Floor and bench** model 9" lathes presented in 12-page catalog. Includes 42 attachments and accessories for adaptation to maintenance demands. Catalog 5304, South Bend Lathe Works, 425 E Madison St, South Bend 22, Ind.

37 **Soluble oil** for metal cutting, grinding and forming operations discussed in 3-color folder. Operating instructions and recommended dilutions incl. Bulletin SO53. Shear-Speed Chem Prod Div, Michigan Tool Co, 7125 E McNichols Rd, Detroit 12, Mich.

38 **Oils for wide industrial** application discussed in Tech Bulletin 17. Physical properties and advantage of new *Solnus* oils presented. Sun Oil Co, Philadelphia 3, Pa.

39 **Control equipment maintenance** explained in 6-page booklet. Quick reference chart for trouble-shooting included. Bulletin 14X7612A. Allis-Chalmers Mfg Co, General Machy Div, Milwaukee 1, Wis.

40 **Helically-wound flexible metal hose** described in 2-color, 49-page catalog. Includes charts on frictional losses vs flow rates, photo story on the making of seamed metal hose, specification page. Catalog 200. Titeflex, Inc, 500 Frelinghuysen Ave, Newark 5, N. J.

41 **Steam vapor and high pressure** combination cleaners presented in 2-page folder. Demonstration photos, spec charts and accessories list included.

How to make

ACCURATE BOILER WATER pH, PHOSPHATE, NITRATE TESTS

USE TAYLOR COMPARATORS

You can make many determinations in seconds . . . longest take only two minutes. Taylor Sets are lightweight, easy to carry for on-the-spot tests, or you can use them in the lab. Each set complete with accessories and reagents.

Easy as A • B • C

A. Fill three test tubes with sample to be tested and place them in the base.

B. Add reagent to middle tube only.

C. Place color slide on base, move across until colors match, and . . . THERE'S THE VALUE!

Guaranteed Color Standards!

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for equipment. Write direct for FREE HANDBOOK on pH and Chlorine control in 34 basic industries. Also illustrates and describes all Taylor Sets.

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YORK RD. & STEVENSON LANE • BALTO. 4, MD.

a teaspoonful of steam!

HERE'S THE ANSWER TO YOUR SMALL FLOW CONTROL PROBLEMS

a NEW LESLIE REDUCING VALVE

for accurate, foolproof regulation of small flows of steam, air, gas or liquids, with inlet pressures to 1000 psi and reduced pressures from 2 to 400 psi.

Change operating conditions quickly and easily with simple, handwheel adjustment —no need to waste time changing springs or swapping parts. Check these widely accepted Leslie features that are standard in the new, efficient, Leslie Small Flow Reducing Valve.

Check these Features

- ✓ Simple, compact construction
- ✓ Top quality materials
- ✓ Metal Diaphragm
- ✓ Entirely enclosed—no stuffing boxes
- ✓ Corrosion resistant springs
- ✓ Hardened stainless steel valve
- ✓ Interchangeable inner valves

SEND FOR DESCRIPTIVE BULLETIN 511-A WITH *COMPLETE* CAPACITY TABLES

Before you order—

The new Class LCB is just one of the many units that are *special* with most manufacturers but are *standard* with Leslie.

Check to see if any pressure, temperature or level control you want is standard with Leslie, before you order. Play it safe. Your Leslie Engineer is listed under "Valves" or "Regulators" in the classified telephone directory in principal cities.

LESLIE

THE FIRST NAME IN PRESSURE, TEMPERATURE AND LEVEL CONTROLS

Since 1900

LESLIE CO., 235 Grant Avenue, Lyndhurst, New Jersey

Sound Engineering

by

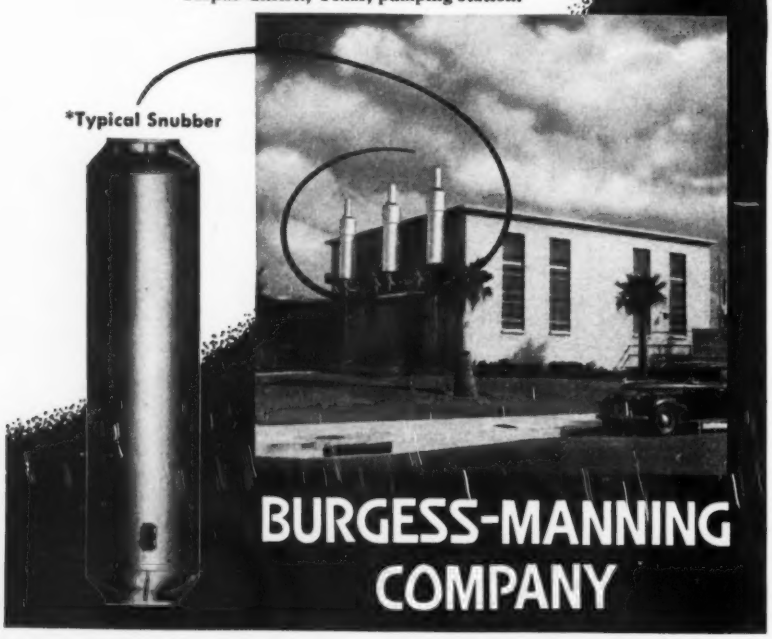
BURGESS-MANNING COMPANY

. . . wherever the flow of AIR, STEAM, and other GASES create N-O-I-S-E.

Standard Snubber* designs are available, incorporating Air Cleaning, Spark Arresting, Water Separation, Waste Heat Recovery, and Surge Control Features.

You can depend upon Burgess-Manning Engineers for a quality product . . . and SOUND ENGINEERING counsel to solve your noise problems.

Burgess-Manning Snubbers installed at Corpus Christi, Texas, pumping station.



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More FREE BULLETINS

Begins on page 163

Malsbary Mfg Co, 845 92nd Ave, Oakland 3, Calif.

42 **Quick connect-disconnect couplers,** ¼ in. to 8 in. dia, for air, water, oil, gas, steam handling. Feature reduced coupler weight and 80% indicated flow. Catalog VP 83. 7 pages with full spec charts. Snap-Tite, Inc, Union City, Pa.

43 **Hard facing** to reduce maintenance and replacement costs discussed in 2-color folder. Includes application of alloys to lineal, cylindrical, contoured shapes. Cleveland Hard Facing, Inc, 3047 Stillson Ave, Cleveland 5, Ohio.

44 **Restful color** group of paints for plant interiors and machinery described in 6-page, color-chip folder. Form 125. Rust-Oleum Corp, 2799 Oakton St, Evanston, Ill.

45 **Floor resurfacing** and proportions for mixing ingredients for specific jobs discussed in 2-page folder. AIA File 23-D. United Laboratories, Inc, 16801 Euclid Ave, Cleveland 12, Ohio.

METERS AND INSTRUMENTS

46 **Pressure and vacuum gages** for measuring vacuums as great as 10-11 mm Hg and pressures up to 150,000 psi described in 32-page catalog. Catalog 7001. Minneapolis-Honeywell Regulator Co, Wayne and Windrim Aves, Philadelphia 44, Pa.

47 **Gas analysis equipment** for thermal conductivity measurements explained in 8-page booklet. Data sheet included. Folder ND46-91(2). Leeds & Northrup Co, 4934 Stenton Ave, Philadelphia 44, Pa.

48 **Safety valves** for steam power plants described in 2-page illustrated folder. Valve selection and spec tables incl. Bulletin 194, Frick Co, Waynesboro, Pa.

PUMPS

49 **Ceramic plungers** for reciprocating pumps described as to properties of plungers and manufacturing process. Bulletin W-404-B5. Worthington Corp, Harrison, N. J.

50 **Pneumatic pump** with only one moving part pumps problem materials by old principle of operation. Unaffected by temperatures, pumps almost anything that will flow into it. Bulletin 4600. Photos, diagrams, specs. Yeoman Bros Co, 1999 N Ruby St, Melrose Park, Ill.

51 **Screw pumps,** double external bearing and gear type, double external bearing and gear hopper type, and gear-in-head type, described in two illustrated bulletins. Cutaways and spec tables incl. Bulletin WQ-S205 and WQ-S206. Warren Steam Pump Co, Warren, Mass.

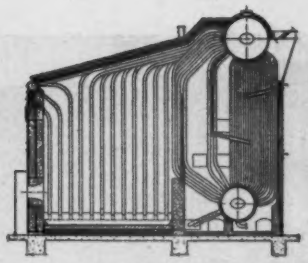
52 **Instruction booklet** for De Laval pumps includes installation, maintenance, and parts list. 2 pages with exploded views and sketches. Bulletin L314A-6. De Laval Steam Turbine Co, Trenton 2, N. J.

MISCELLANEOUS

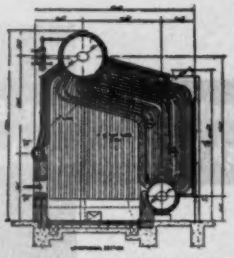
53 **Industrial castings** for use in aviation, chemical, diesel, and general industrial fields described in 12-page booklet. Photos, spec charts, graphs. American Brake Shoe Co, Dept A, 230 Park Ave, New York 17, N. Y.

54 **Stress rupture** values of tubing steels and other materials designed for high temperature service presented in new data card, TDC-153. Babcock & Wilcox Co, Tubular Products Div, Beaver Falls, Pa.

★ **Automatic water softener** equipped with pilot-operated, diaphragm-type hydraulic valves. Automatic control unit can be installed on existing water softeners. Bulletin 612, 2 pages with photos. ★Request direct on company letterhead to Elgin Softener Corp, Elgin, Ill.



2 Drum Water Tube Boiler



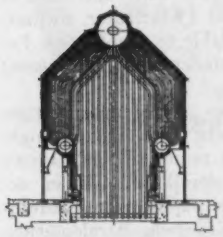
Type-S 2 Drum Boiler Series S1

FOR ALL INDUSTRY...

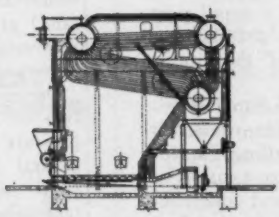
WICKES

STEAM GENERATORS

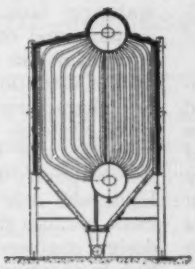
• In the oil, paper and chemical industries and in manufacturing plants, institutions and public buildings throughout the world Wickes Steam Generators are in constant daily service. All types, such as those illustrated on this page, with capacities up to 250,000 lbs. steam per hour and 1000 psi. Write for descriptive literature.



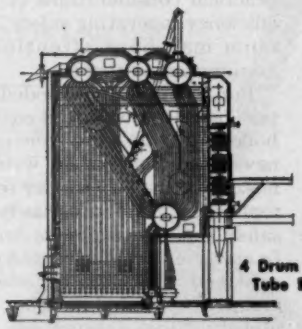
"A" Type Water Tube Boiler



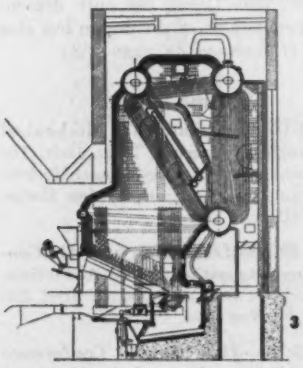
3 Drum Low Head Water Tube Boiler



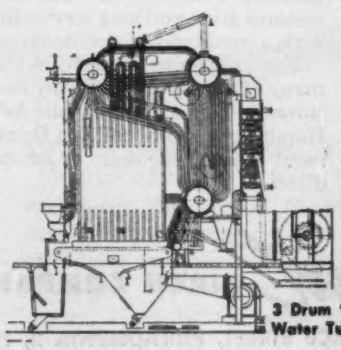
Wickes 2 Drum Waste Heat Installation



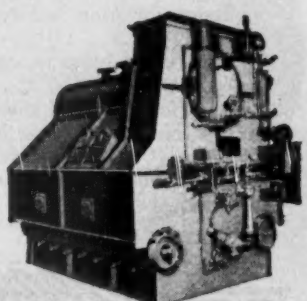
4 Drum Water Tube Boiler



3 Drum Water Tube Boiler



3 Drum "B" Type Water Tube Boiler

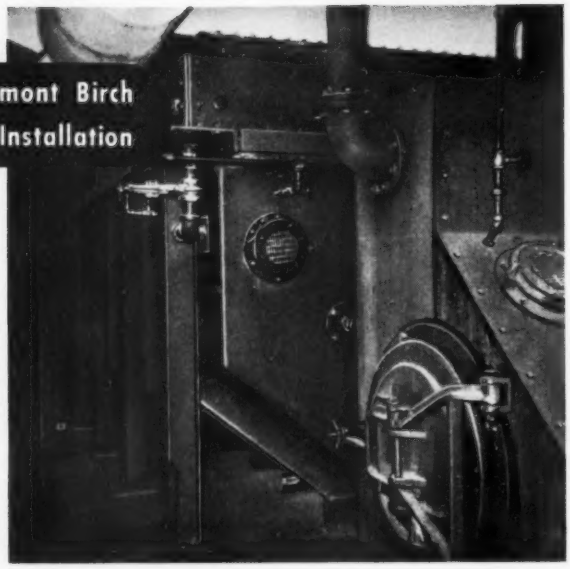


Type "A" "Packaged" Steam Generator

THE WICKES BOILER COMPANY • DIVISION OF THE WICKES CORPORATION, SAGINAW, MICHIGAN

RECOGNIZED QUALITY SINCE 1854 • SALES OFFICES: Atlanta • Boston • Buffalo • Chicago • Cincinnati • Cleveland • Denver • Greensboro, N.C. • Houston • Indianapolis • Los Angeles • Memphis • Milwaukee • New York City • Pittsburgh • Portland, Ore. • Saginaw • San Francisco • Springfield, Ill. • Tampa, Fla. • Tulsa • Washington, D.C.

Another Beaumont Birch Ash Handling Installation



Discharge end section of a flooded hopper for Beaumont hydraulic system showing rugged supporting structure and circular protected observation ports of special heat resistant glass.

Why BEAUMONT BIRCH Hydraulic Ash Handling Systems Assure You

Reliable, Efficient Service

In every detail of Beaumont Hydraulic Ash Handling Systems, you'll find they're designed for practical considerations of boiler efficiency, operating safety, minimum man-hour attention and minimum maintenance.

For example, on flooded hoppers beneath pulverized coal fired boilers, costly shut downs are never necessary when water jet nozzles in the ash hopper require replacing. They are easily and safely replaced *while the boiler is in operation* . . . the rugged sluice gate and operating cylinder are mounted on a single casting, completely shop assembled. This assures perfect alignment of cylinder for long uninterrupted service.

On flooded hoppers, operators are always protected at observation ports by special glass resistant to thermal shock, in addition to a protecting metal guard. Built-in spray washers keep all observation ports clean and free from dirt and fog.

These and many other points, such as, sluiceways, sumps, dewatering bins, flyash handling systems and other supplemental equipment are only a small part of the attention to details that are characteristic of Beaumont Birch Systems.

Power and Consulting Engineers specify Beaumont Birch Hydraulic Ash Handling Equipment because they are assured of design, engineering and construction to exacting specifications!

Beaumont's background of over fifty years in the design and manufacture of ash handling systems gives you long service life with a minimum of maintenance.

For complete details of the many efficiency and economy features of Beaumont Hydraulic Ash Handling Systems, call in a Beaumont Birch engineer or write direct.

Beaumont BIRCH COMPANY

1502 RACE STREET, PHILADELPHIA 2, PA.

DESIGNERS — MANUFACTURERS — BULK MATERIAL HANDLING SYSTEMS

More POWER NEWS

Begins on page 148

From the top of the cliff the water will be lead through penstocks to twelve 100,000-hp units operating under a 295-ft head. To supply additional peak power, plans include a pumped-storage plant that will be installed in the side of the canal now under construction. This will pump water into an elevated reservoir of 5-billion gallon capacity.

Water flowing back to the canal from this reservoir will operate the pumping plant as a 225,000-hp generating station. In addition, the pumped water will permit installing four more 100,000-hp units in the main plant whenever they may be required. After completion, this development will have a total installed capacity of 1,825,000 hp.

Present work needed on this project includes widening the canal to supply water for these four additional units. Also, further work will be done now—work that could be completed later only at much higher cost.

Even with an early go ahead, power from the proposed St Lawrence development will not be available to meet the 1957 peak load in the Ontario hydro system. Therefore alternative sources are necessary to meet the demand expected in that year. The new pumped-storage project is one of these sources.

Combustion Engineering Signs Agreement with Sulzer Bros

PATENTS, designs and experience of Sulzer Bros, Ltd (Winterthur, Switzerland) are available to Combustion Engineering, Inc under terms of a recent agreement.

Decision grows out of an investigation of European once-through high-pressure boilers to see if Combustion's natural and controlled-circulation designs might be supplemented advantageously by European developments. Study revealed that many successful installations of Sulzer *Monotube* units (POWER, Nov 1945) not only demonstrated soundness of the design but also

(*Continued on page* 238)

Coming Events

Oct 9-15—International Mechanical Engineering Congress, Turin, Italy. The Permanent Secretary, International Mechanical Engineering Congress, 10 Ave Hoche, Paris VIII eme, France.

Nov 9-12—Refrigeration and Air Conditioning Exposition, Public Auditorium, Cleveland, Ohio. Write Banner & Greif, 250 W 57th St, New York 19, N. Y.

Mar 15-19—10th Annual Conference and Exhibition, National Association of Corrosion Engineers, Kansas City, Mo. A B Campbell, Executive secretary NACE, 1061 M&M Bldg, Houston 2, Texas.

GLOBE

specialization gives you
"Tops in Quality"

ALLOY STEEL TUBES

SEAMLESS — MECHANICAL — PRESSURE — CORROSION RESISTANT

TYPICAL ANALYSES:

Carbon	5 Chrome ½ Moly
Carbon ½ Moly	7 Chrome ½ Moly
½ Chrome ½ Moly	8 Chrome ½ Moly
1 Chrome ½ Moly	8 Chrome 1 Moly
1¼ Chrome ½ Moly	9 Chrome 1 Moly
2 Chrome ½ Moly	3% Nickel 7% Nickel
2¼ Chrome 1 Moly	5% Nickel 9% Nickel

AISI Types: 304-321-347-316-309-310-405-410-430-443-446

Analyses to meet conditions where heat, corrosion, pressure and structural strength are involved.

SIZE RANGE — WALL THICKNESS:

½ to 6 inches O.D. — wall thickness .035 to 1,000 inch.

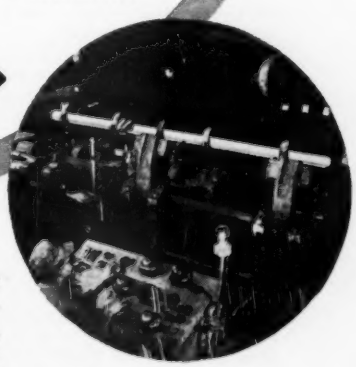
TYPICAL APPLICATIONS:

Pressure tubes — Superheater tubes — Condenser tubes — Still tubes — Evaporator tubes — Barrel tubes — Oil-well Pump Barrels — Mechanical tubes — Aircraft tubes — Propeller tubes — Rollers for Transmission Chains.

Globe engineers gladly give you the benefit of specialized knowledge of stainless steel tubing in a wide range of services and applications — to improve your product — to cut costs.

TO BE SURE . . . SPECIFY GLOBE

The heating, piercing, rolling of seamless tubes is controlled at every step for uniformity, close tolerance.

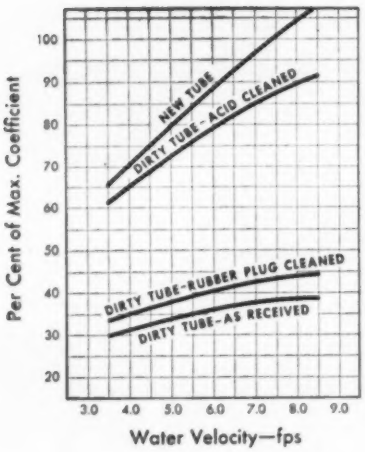


WHEN you specify Globe, you get uniform high quality alloy steel tubes, the product of highly developed production facilities and specialized quality controls and methods. All Globe tubes are thoroughly inspected and closely held within tolerance specifications. Write for the Globe general catalog.

GLOBE STEEL TUBES CO.

Milwaukee 46, Wisconsin Chicago • Cleveland • Philadelphia • St. Louis • New York Detroit • Denver • Houston • San Francisco • Glendale, Cal.

Producers of Globe seamless stainless steel tubes — Gloweld stainless steel tubes — alloy — carbon — seamless steel tubes — Globeiron (high purity ingot iron) seamless tubes — Globe Welding Fittings.



Best way to RESTORE condenser tube EFFICIENCY

90% of surface condensers do not perform as well as they should. One major cause is fouled tubes. And, only too often, when such tubes are rubber-plug cleaned, the results prove far from satisfactory.

In a recently reported test, it was shown that shooting rubber plugs through a fouled tube didn't fill the bill in successfully removing the type of scale encountered. See chart. But when the same tube was acid-cleaned, the heat transfer obtained approximated that of a new and clean tube.

Removing lime scale with that effective acid-descalant, Oakite Compound No. 32, more than repays for itself by the savings it makes in reduced turbine-steam consumption and lower fuel costs. It minimizes tube failure caused by partially obstructed tubes and eliminates the cost both of replacing tubes and of idle condenser capacity.

After you have removed lime scale with Oakite Compound No. 32, you can prevent further build-up by treating condenser circulating water with Oakite Airefiner No. 52. For further details, write for booklet. No obligation. Oakite Products, Inc., 23 Rector Street, New York 6, New York.

SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS • METHODS • SERVICE

Technical Service Representatives Located in Principal Cities of United States and Canada

My Biggest Boner

► A few years back I had charge of the boiler room in a small food processing plant. Because the room was quite small there was only about three feet between outside of furnace wall and building wall. Blowdown line ran from boiler to a concrete pit covered with planks.

I blew down regularly at noon every day, having the fireman watch the water gage. The day our fireman was sick turned out to be the day I nearly committed my worst boner.

As usual, I blew down at noon, opening both valves. Then I stepped to the front of the boiler because, with the fireman out sick, someone had to watch the water level. When I turned to go behind the boiler to close the valves a billow of steam hit me in the face. Water entering the pit was flashing into steam and it soon filled the small boiler room.

I wrapped some rags around my face, pulled on my gloves and threw a rain coat over my head. By this time there was two inches of hot water on boiler room floor that I had to wade through before I could close the valves.

Luckily, when I got out in front of the boiler again there was still some water visible in the gage. Right then and there I made my mind up that this was the first and last time I'd ever leave blowoff valves open to go and check water level. Have two men for this job, or place water gage so it can be seen from blowdown station.

GEORGE MILLBURN
Stratford, Canada

• What is your "biggest boner"? We'll pay ten dollars for each one we publish.

Alfred Iddles, president of **The Babcock & Wilcox Co,** announced the establishment of an Atomic Power Division of the company. C H Gay, vice president and formerly head of the manufacturing department of the company's Boiler Division, has been placed in charge of the new division.

JUST WAIT 'TILL YOU SEE THE *New* Lonergan SAFETY VALVE in the September issue of Power

— *SENSATIONAL* —

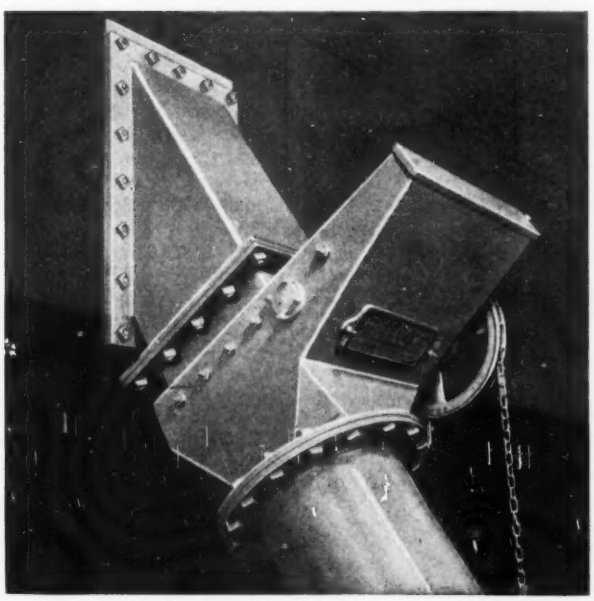
NEW DESIGN FEATURES
NEW INSTALLATION AND OPERATION ADVANTAGES

Drawing upon our long experience in the manufacture of safety-relief valves we have developed this new valve in a wide range of sizes. Its many advanced features make it the last word in safety valves. We'll tell you, all about it next month. Here's a tip . . . it's well worth waiting for!

Lonergan
J. E. LONERGAN COMPANY
Established 1872
RACE & 2nd STREETS • PHILA. 6, PA.

The Operator With the S-E-Co. Coal Valve

S-E-Co. Coal Valve shown below is Style 2BS, designed for inclined installation. This style features 2" offset between inlet and outlet centerlines and a disc brake to prevent gate from self-closing.



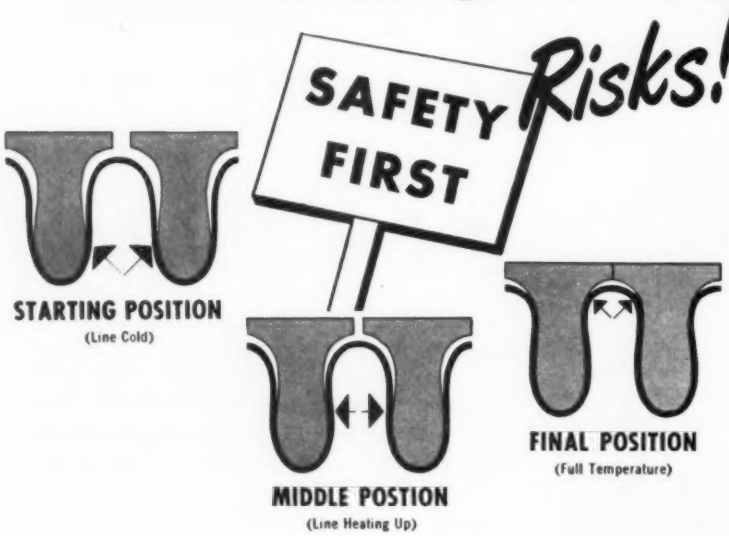
can rely on dependable, easy gate operation because the double racks and pinions prevent gate cocking and binding; the U-shaped gate keeps coal and moisture from operating parts and prevents sticking and wear; roller bearing equipped rollers with pressure greasing and dust-seals support the gate and insure free motion; and the operating shaft is mounted on anti-friction bearings.

Purchase your valve requirements from Stock Equipment Company, where valves are a specialty and receive the attention to design and construction they require. Stock Equipment Company has a full line of valves in sizes ranging from 6" to 42" designed to control coal, soot or siftings, or bulk materials. For bulletin or help on your valve problem, write to

STOCK EQUIPMENT COMPANY
745P HANNA BUILDING
CLEVELAND, OHIO

Badger * DF-SE EXPANSION JOINTS

The Joint that Doesn't Ask The Corrugation to Take Risks!



Call it conservatism on our part, if you like, but this whole matter of corrugation design involves an engineering safety factor that should be important to you when in the market for expansion joints. There's an economy factor, too.

We refer to the very definite relationship in the Badger Joint between the depth of the corrugation and the limit placed on the traverse for that depth. This is the safety factor. And since the traverse limit is consistent, it is a simple matter to select the size of joint that will give full traverse but need not be over-traversed. This is the economy factor. Our latest Bulletin gives full details of these important points.

Thus with the Badger Joint, you are protected against the danger of under-traverse and against uneconomical buying resulting from over-traversing. The Badger corrugation is never asked to do too much. Neither is there unusable excess traverse. With graduated corrugation depths, you can get a Badger Joint that will closely meet carefully calculated corrugation requirements for pipe size and anticipated traverse.

* Directed-Flexing, Self-Equalizing . . . exclusive with Expansion Joints designed and manufactured by . . .

BADGER MANUFACTURING COMPANY

Original and Sole Manufacturer of Badger Expansion Joints

230 BENT STREET • CAMBRIDGE • MASS.

More POWER NEWS

Begins on page 148

indicated features of proved advantage for high-pressure steam generation. Further, it was felt that Sulzer's research and specialized experience with the once-through type could contribute materially to studies Combustion has been making of problems involved in generating steam at 5000 psi and higher.

Internat'l Boiler Code News

RESULTS OF FIRST formal meeting to develop an international boiler code were most encouraging, according to F X Gilg, Babcock & Wilcox Co, who headed the American delegation. This first meeting of ISO/TC-11 (see POWER, June 1953, pp 242, 244) was attended by 76 delegates from Austria, Australia, Belgium, France, Germany, Holland, Italy, Spain, Switzerland, United Kingdom and the United States. It was the largest International Standards Organization (ISO) meeting ever held and the first time that boiler makers from so many nations met to discuss mutual problems.

Great interest shown indicates a real need for an international code. Cooperative spirit of the delegations in arriving at compromises not yet permitted by their respective boiler laws indicates that the prestige of an ISO code or recommendation would be very strong.

Agreements were reached on 12 draft resolutions, including a design formula for cylindrical shells, rules for riveted construction, inspection and stamping. After some discussions in working groups, three subcommittees were recommended to continue studies on (1) materials (2) allowable stresses and design formulas (3) welding.

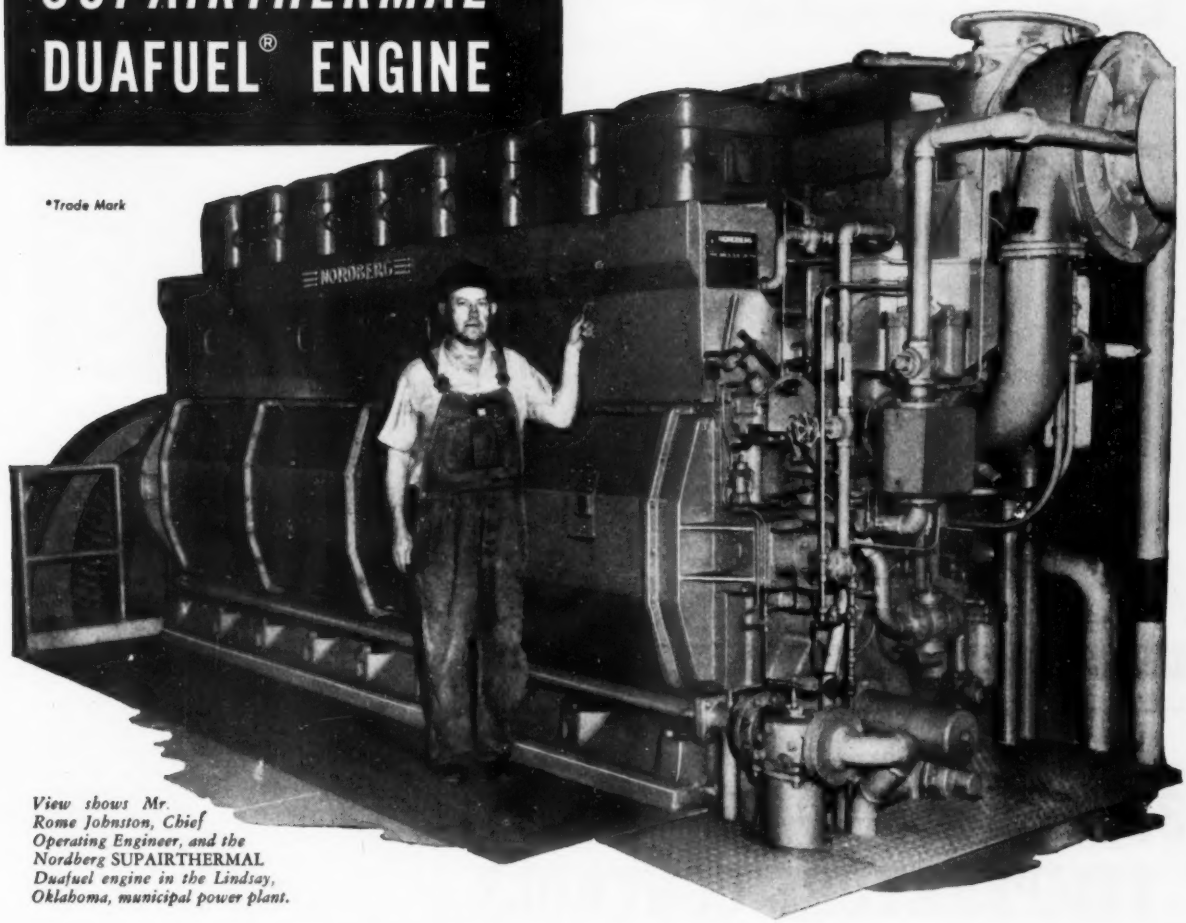
These subcommittees will carry on work started at the Paris meeting. To make it easier to get this done without trans-Atlantic travel, Germany was invited to take the secretariat of the committee on materials, France the committee on allowable stresses and design formulas, and Holland the committee on welding. Since the ASME Boiler Code Committee is the secretariat for ISO/TC-11, it will charge these subcommittees to resolve their differences by correspondence and local meetings. It is hoped that another meeting of the full committee can be held in about two years, to finalize discussions so an ISO recommendation can be circulated for approval among those concerned.

While agreements reached by ISO/TC-11 may have some long-range effect on boiler laws in various countries, boilers built for installation in the U.S. and Canada will always have to comply with the ASME Boiler and Pressure Vessel Code as they do today.

NORDBERG *SUPAIRTHERMAL** DUAFUEL® ENGINE

HIGH EFFICIENCY INCREASES POWER PLANT PROFITS

*Trade Mark



View shows Mr. Rome Johnston, Chief Operating Engineer, and the Nordberg SUPAIRTHERMAL *Duafuel engine in the Lindsay, Oklahoma, municipal power plant.*

AT the Lindsay, Oklahoma, municipal plant, a Nordberg *SUPAIRTHERMAL* Duafuel engine is generating energy at an average fuel cost of 2.5 mills per kwh at 58.5 percent average load factor. This Nordberg four-cycle, 8-cylinder engine is rated 1425 horsepower, 1000 kilowatts, at 450 rpm.

Since this 13″ x 16½″ *SUPAIRTHERMAL* engine was placed in service, it has been operating over 98 percent of the time. Data compiled by C. H. Guernsey & Co., consulting engineers, show savings in fuel costs of over $1200 per month as against straight oil operation. In addition, this engine has maintained a lubricating oil economy of approximately 18,000 HP/hrs. per gallon.

Because of its compact design, the 1425 hp Nordberg *SUPAIRTHERMAL* engine was installed in the very limited floor space formerly occupied by a 200 HP unit, eliminating the necessity for costly building expansion.

When *you* need more economical, compact power, investigate the tested and proved advantages of Nordberg *SUPAIRTHERMAL* engines, in sizes from 535 to 4260 HP. *For details, write for Bulletin 191.*

NORDBERG MFG. CO., Milwaukee, Wisconsin

NORDBERG

DIESEL • DUAFUEL® AND SPARK-FIRED GAS ENGINES

P853

tubes

all sizes and gauges always on hand

ACCURATELY FABRICATED

BOILER TUBE CO

OF AMERICA

McKEES ROCKS, PA.
Pittsburgh District

PITTSBURGH • CHICAGO • FRED S. RENAULD & CO., LOS ANGELES

Another Large Firm Adopts

$35 NICHOLSON TRAPS AS TEMPERATURE CONTROLS

Because they serve effectively as temperature controls as well as steam traps, and cost only about $35, Nicholson expansion steam traps are being increasingly installed in place of temperature regulators. A large processor recently installed these Nicholson units on outdoor storage tanks after thorough tests showed a less than 2°F variation in outlet condensate temperature. Regulators had been costing them $110.00 to $200.00, with cost of a trap added.

Nicholson expansion steam traps are easily adjusted to pass condensate at any temperature below 212°F. Because there is only one moving part, remarkably low maintenance costs are being shown. Easily installed, usually without supports. Lengths, 9" to 40". Press. 0 to 250 lbs. Freezeproof.

For All Equipment Using Steam or Hot Water

Dryers	Pipe Coils
Evaporators	Radiators
Heat Exchangers	Retorts
Heaters	Separators
Kettles	Steam Stills
Paper Machinery	Storage Tanks

CATALOG 751

125 Oregon St., Wilkes-Barre, Pa.

W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

APPOINTMENTS

Ford Kurtz

Corporation Executive Changes

J G White Engrg Corp: Ford Kurtz, from vice-president to president; Edward N Chilson, from vice-president to chairman of the board. **American Brake Shoe Co:** M B Terry, from executive vice-president to president of American Brakeblok Division. **Combustion Engrg, Inc:** Broderick Haskell, from member of the board and of the executive committee to vice-chairman of the company.

Crane Co: Lucien W Moore, from director of purchases to vice-president; George L Larson, from general superintendent of the Chicago works to executive assistant. **Ajax Flexible Coupling Co, Inc:** William T Welch, president; Wayne Belden, executive vice-president; Charles Belden, vice-president.

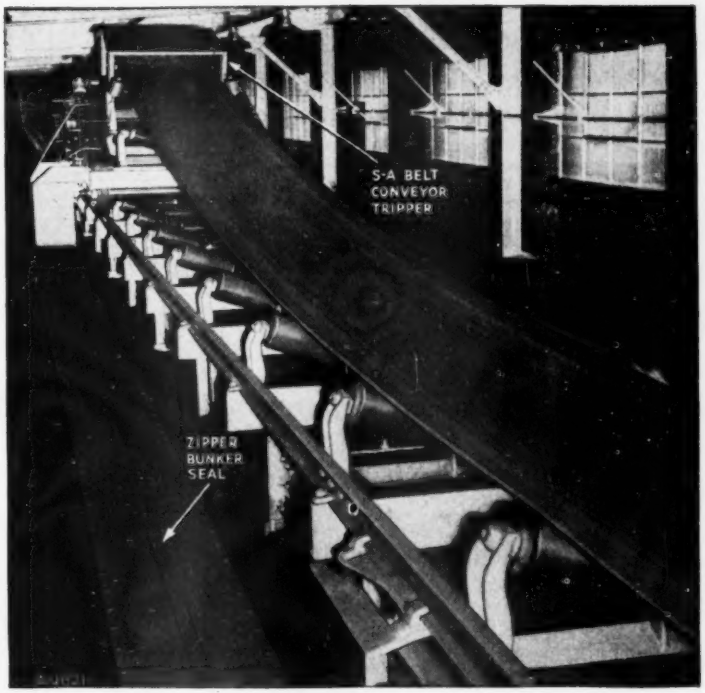
Fluor Corp, Ltd: Jan Oostermeyer, former president of Shell Chem Corp to member of the board. **Northwest Electric Light & Power Assn:** A W Trimble, president; R C Stetterstrom, first vice-president; E M Naughton, second vice-president; J R Cawlfield, treasurer. **Peabody Engrg Corp:** Eric G Peterson to executive vice-president. **Union Carbide and Carbon Corp:** George C Miller to president of Bakelite Co, a subsidiary.

Operations Executive Changes

Babcock & Wilcox Co: Frank X Gilg, from application engineer to executive assistant in the boiler division; W Tom Moore, from development and design engineer to executive assistant in the atomic power division. **J G White Engrg Corp:** H P Jackson, vice-president—construction; Robert H Barclay, vice-president—engineering.

Westinghouse Electric Corp, jet division: Hewett R Arnold, assistant division manager; Thomas A Daly, manager of technical operations; Joseph F Chalupa, manager of manufacturing, South Philadelphia plant; James W Fatkin, assistant to division manager; Vincent J Gordon, assistant manager, production.

S-A CONVEYING System



Feeds Coal to
"ZIPPERED"
Bunkers **Without Dust . . .**
or Stockpiles it **"Automatically"**

IOWA POWER AND LIGHT COMPANY, Des Moines, Iowa

The S-A Conveying System at this plant provides complete handling and distributing facilities for coal with a minimum of supervision. Coal moves from receiving hoppers, through breaking and sizing, to bunkers, or to and from stock pile as needed. Completely modern, the system has a capacity of up to 300 tons per hour.

At this plant, coal being fed to bunkers never gets a chance to be a dust problem!

As the belt conveyor tripper travels back and forth above the bunkers, its two discharge chutes automatically open and close a Zipper bunker seal, just as you open and close a slide fastener. Since the Zipper is open *only at the chute*, no dust can escape from the bunkers.

Also unusual is this system's stocking out boom conveyor. It discharges through a telescoping chute that automatically raises with the level of the stock pile, under actuation of a heavy duty S-A Tellevel Control.

These are typical examples of the way S-A engineers meet specific job needs. Whatever *your* problem, S-A experience, plus the complete line of S-A bulk handling equipment, can provide an efficient answer to reduce your handling costs. Write for more details.

- Belt Conveyors
- REDLER Conveyor-Elevators
- ZIPPER Conveyor-Elevators
- Weigh Larries
- Crushers, Roll & Ring Type
- Bucket Elevators
- Pivoted Bucket Carriers
- Screw Conveyors
- Skip Hoists
- Belt, Pan & Plate Feeders
- Track Hoppers & Bin Gates
- TELLEVEL Bin Level Controls
- Water Intake Screens
- SEALMASTER Ball Bearing Units

Write for a bulletin on any of the above

STEPHEN S-A ADAMSON MFG. CO.

5 Ridgeway Avenue, Aurora, Illinois — Los Angeles, Calif., Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

Skill with Smoke

Efficiently removing the *sting* from industrial smoke requires considerable skill and experience. Buell has spent the past twenty years acquiring both!

Because dust content varies, Buell specialists first analyze the dust, then make a detailed study of on-the-job conditions. It is because of this sound approach that Buell has been so unusually successful.

Users of Buell equipment, many of them leaders in their own fields, have reported that the collection of dust has greatly improved employee morale, increased production and made really significant contributions to plant-community relations. We will be glad to supply the names of present Buell users right in your own field.

Our informative brochure—The Collection and Recovery of Industrial Dusts—explains all *three* Buell systems for industrial dust collection. For your complimentary copy write Dept. 50-H, Buell Engineering Company, 70 Pine Street, New York 5, N. Y.

buell®

MECHANICAL ELECTRICAL *20 Years of Engineered Efficiency*
DUST COLLECTION SYSTEMS

More APPOINTMENTS

Begins on page 240

Westinghouse Atomic Equipment Dept: Leo B Dorsner, supervisor of manufacturing; Ralph M Yearick, supervisor of production; Benjamin Cametti, manager of pump engineering section. Westinghouse Pacific Coast District: Willis L Winter, from assistant to the manager of the electric utility dept to distribution apparatus manager.

Engineer Changes

Bailey Meter Co: H H Gorrie, from assistant chief engineer to chief engineer. **Allis-Chalmers Mfg Co:** John Pappas and David T Rayner Jr, from the training course for graduate engineers to the plant engineering department. **Designers for Industry, Inc:** Charles E Freese, project engineer—mechanical development div; Vern L Ripley, senior project designer—mechanical development division.

Koppers Co, Inc: Fred A Robbins, chief engineer of the piston ring dept. **Tenney Engineering, Inc:** Peter K Baade, test engineer for the environmental test chamber div. **Gregory Industries, Inc:** A G Bissell, from head civilian of the Welding, Casting and Forging Branch of the U. S. Navy's Bureau of Ships to engineering consultant for Nelson Stud Welding Division.

New Sales Vice-presidents

Republic Steel Corp: Norman W Foy, from general sales manager to vice-president in charge of sales. **Associated Engineers, Inc:** Gordon M Genge, from sales engineer for Electric Machinery Mfg Co, Inc to vice-president and sales manager. **Anderson Bros Mfg Co:** Walter E Gunnerson, from sales manager and chief engineer to vice-president in charge of sales.

Sangamo Electric Co: James H Patton, from utilities and industrial div sales manager to vice-president and sales manager. **Thor Power Tool Co:** J A Hill, vice-president and sales manager; B H Johns, vice-president—rock drill sales.

New Sales Managers

Trane Co: Ben A Schwirtz, Cleveland sales office. **General Electric Co:** Arnold Jensen, Conduit Standard Lines sales; Emmett E Hinson Jr, industrial laminates and insulating materials; T F Mackey, heavy industries; K R Ross, medium industries; W V Gough, light industries; H D Beale, industry products maintenance; F W McChesney, industry sales procedures.

Graybar Electric Co, Inc: J J Lieske Jr, Washington D. C.; D E Clisbee, Hammond, Ind; E W Windahl, Duluth, Minn; J T Baker, Youngstown, Ohio; F F Jaspersen, Philadelphia, Pa; Hamilton Corey, Atlanta, Ga. **Precision Transformer Corp:** John R Smith Jr, sales manager and assistant to the president. **Combustion Control Corp:** Kenneth R Blaine, Atlanta, Ga; Adolph J Erickson, Dallas, Texas.

Hydropress, Inc: Bernard Anscher, domestic sales. **Elliott Co:** M L Hiller, Washington, D. C. district. **Chrysler Corp,** Airtemp Div: Peter J Dalton, Detroit region. **Stearns Magnetic Inc:** Gordon E

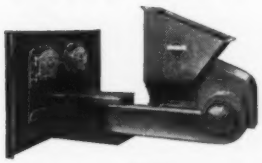
THERE'S A CANTON STOKER TO MEET EVERY MODERN NEED—ECONOMICALLY

CANTON STOKER CORPORATION

***Specialists in* Automatic Coal FIRING, HANDLING and CONTROL Equipment**

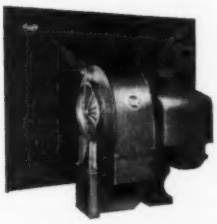
CALL THE REPRESENTATIVE NEAREST YOU

HERE ARE THE OUTSTANDING TYPES, SIZES, STYLES BEING SPECIFIED TODAY . . .



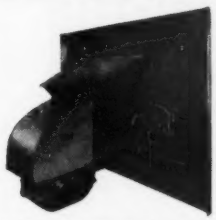
THE DURAFLEX DELUXE WORMFEED

Includes ash dump grates, unit or divided drive. For loads up to 275 H. P.



THE VULCAN RAMFEED

For use where steam demands vary rapidly and service conditions are severe. For loads up to 800 H. P.



THE LO-SET RAMFEED

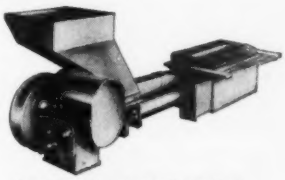
Requires less headroom, saves space and often costly pitting. For loads up to 350 H. P.

THE DURAFLEX STANDARD WORMFEED

Includes solid ash plates, heavy duty tuyeres and sectional feedworm. For loads up to 275 H. P.

LO-SET RAMFEED SINGLE ASH DUMP

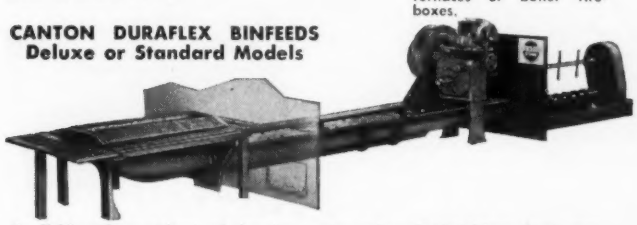
For special or very narrow furnaces or boiler fireboxes.



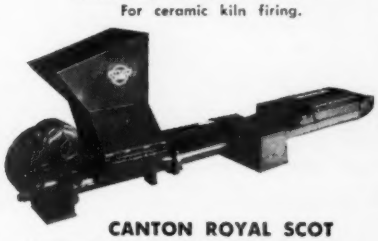
CANTON KILN STOKER

For ceramic kiln firing.

CANTON DURAFLEX BINFEEDS
Deluxe or Standard Models

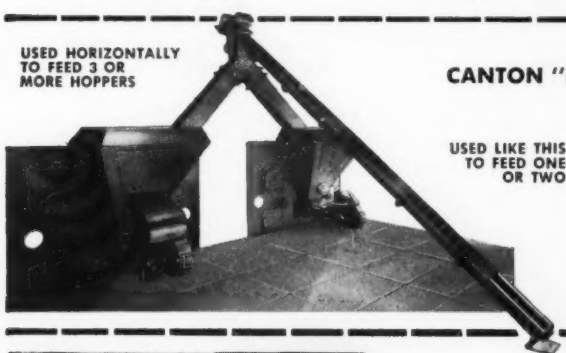


Available with or without ash dumping grates; unit or divided drives; front, rear or side boiler entry; ash sprays and furnace fronts. For loads up to 275 H. P.



CANTON ROYAL SCOT

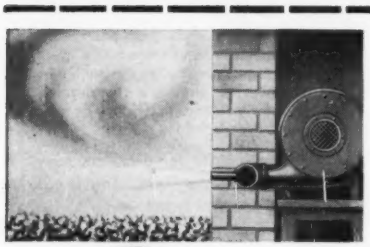
A unit type wormfeed stoker for automatically, efficiently firing Scotch Marine boilers.



CANTON "FLO-TUBE" HEAVY DUTY CONVEYORS

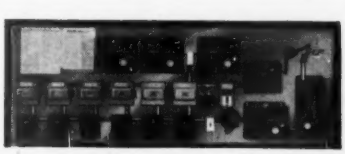
Screw type conveyors deliver coal from bin or pile automatically . . . free men for more exacting duties. "Off-on" switches will maintain desired levels in hoppers. Capacities to 10,000 lbs. per hour. Also widely used for conveying other materials such as steel chips, grain, pellets, wood waste, sand, etc.

COAL ENTERS EXPOSED END



CANTON "TURBO-AIRE" SYSTEMS FOR SMOKE CONTROL

Effects complete combustion. Simply "burns the smoke where the smoke begins." For boilers to 1000 H. P.



CANTON "SYNCHRO" COMBUSTION CONTROLS

Automatically adjusts fuel feed, air supply, boiler draft and combustion rates in proportion to steam demand or water and weather temperatures. Applicable to other forms of proportioning control.

CANTON STOKER CORPORATION

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MISSOURI
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Reach any Overhead Valve From the Floor with...

Babbitt
—Adjustable—
SPROCKET RIM
with Chain Guide

Get positive, efficient control of any overhead valve right from the floor! No expensive apparatus, no switches, no costly detours to bring overhead piping to floor level — because every valve is within easy reach, when you use low-cost Babbitt Adjustable Sprocket Rim with Chain Guide. Easily assembled and installed, ready to operate in a few minutes.

- Safe, sane & sensible
- Cuts piping costs
- Saves fuel & steam

Range of 10 adjustable sizes fits all valve wheels from 2 to 30 inches diameter, with rising or non-rising stems. Only four simple, quickly-assembled parts.

Call your Industrial Distributor. He carries complete stocks. Or write for descriptive folder and prices.

Babbitt STEAM SPECIALTY CO.

2 BABBITT SQUARE, NEW BEDFORD, MASS.

IF you change your address,

please be sure to let us know promptly. It takes time to correct the stencil addressing plate. And we don't want you to miss copies of POWER.

Also . . . . . .

be sure to give us *both*

(1) your OLD address

and

(2) your NEW address.

We need them *both* to make the change —*also confirmation of your company connection and position.*

POWER

330 W. 42d St., New York 36, N. Y.

More APPOINTMENTS

Begins on page 240

Medlock, all company sales. **U. S. Rubber Co:** Warren A Tipton, mechanical goods div. **Appleton Electric Co:** Frank W Wehrheim, all company divisions.

Republic Steel Corp: L S Hanaker, all company sales. **St Paul Hydraulic Hoist:** Eugene J Vineyard, export manager. **J H Holan Corp:** Paul V Dimmick, field organization; Arthur C Frank, Cleveland District.

New Sales Engineers

Minneapolis - Honeywell Regulator Co: Carl C Crawford, N. Y.; William R Bisbee, Wichita; Russell W Cornell and Frank P Mark, Montreal; Albert E Finn, Boston; John P Gille, Tulsa; Robert M Goble, Dallas; Charles A Heyelman, Buffalo; Henry N Jelinek and William G Nash, Cleveland; John F Johnson, Chicago; Jennings K Lagerstrom, Kansas City.

Also, David J McDonald, South Bend; Paul L Meyers, Indianapolis; Billy F Schaible, Denver; Howard P Smith Jr, Pittsburgh; Patrick J Suddick, Toronto; Brian F Trankle and Harold E Musgrove, Los Angeles; Robert L Woods, Milwaukee; Ellery L Hall, Seattle; Charles W Gunthorpe, New Orleans.

General Electric Co: Fred M Pugh, silicone products dept; Richard A Steenrod, Cincinnati silicone sales. **U. S. Rubber Co:** Thomas S Savoury, commodity sales. **Honan-Crane Corp:** Francis D Skelley, New Jersey district; Carl F Holland, central Ohio and western Virginia; Thomas C Tiearney, Detroit-Chicago-Cleveland territory.

Institute Elections

American Society of Mechanical Engineers: Harry Knecht, assistant mechanical plant engineer at Consolidated Edison Co, chairman of the executive committee of the metropolitan section; Dr Frank D Carvin, director of mechanical engineering at Illinois Institute of Technology, member of the executive committee.

American Institute of Electrical Engineers: Elgin B Robertson, president. **Stanford Research Institute:** Dr Herbert T Kalmus, president and general manager of Technicolor Motion Picture Corp, member of the board; Dr William R Burwell, member of the board; William M Friedman, former associate director of Walker Art Center of Minneapolis, member of the staff.

Obituaries

Edward C Badeau, 58, editor of Inco Magazine, May 24.

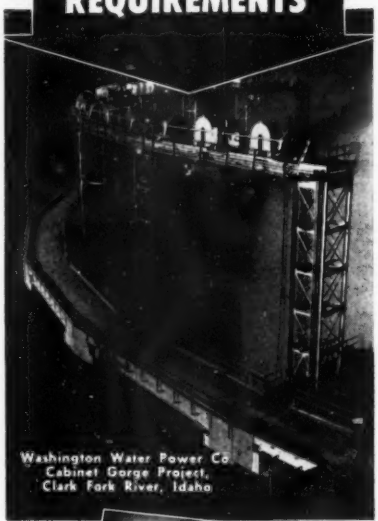
George C Montague, 86, first grinding machine salesman for Norton Co, May 27.

John E Powell, application engineer for Worthington Corp, June 6.

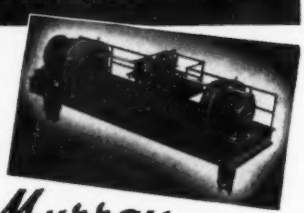
Sumner Simpson, 79, board chairman of Raybestos-Manhattan, Inc, June 13.

Albert W Raymond, European manager of Combustion Engrg, Inc, June 18.

DESIGNED AND BUILT *to meet all* REQUIREMENTS



Washington Water Power Co Cabinet Gorge Project, Clark Fork River, Idaho



Murray GATES *and* GATE HOISTS *for any Size Power Dam*

MURRAY GATE HOISTS are designed and built in a wide range of capacities from less than one ton to over one hundred tons . . . from the smallest hand operated to the largest motor operated gate hoist.

In over 50 years of designing and building gate hoists, we have developed designs for many gate hoist problems. We may have designs and patterns to fit your special requirements. In planning gates or gate hoists, write us before your over-all plans are complete. . . . We also build gate hoists to fit your plans and specifications.

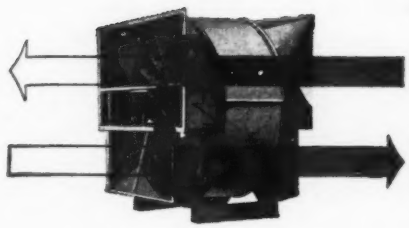
MURCO

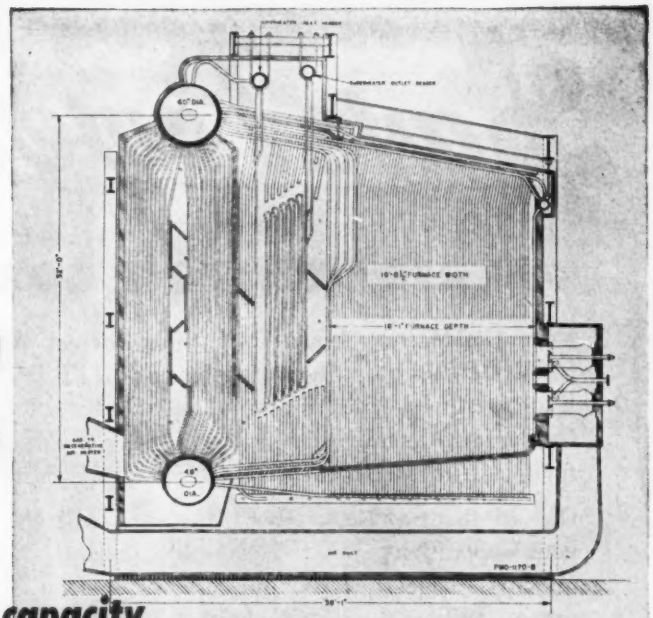
Write for complete information and Engineering Department recommendations.

D. J. MURRAY MANUFACTURING CO.

Manufacturers Since 1883

WAUSAU · WISCONSIN





3,375,000 pounds of steam capacity at Kaiser Aluminum & Chemical Corporation

equipped with

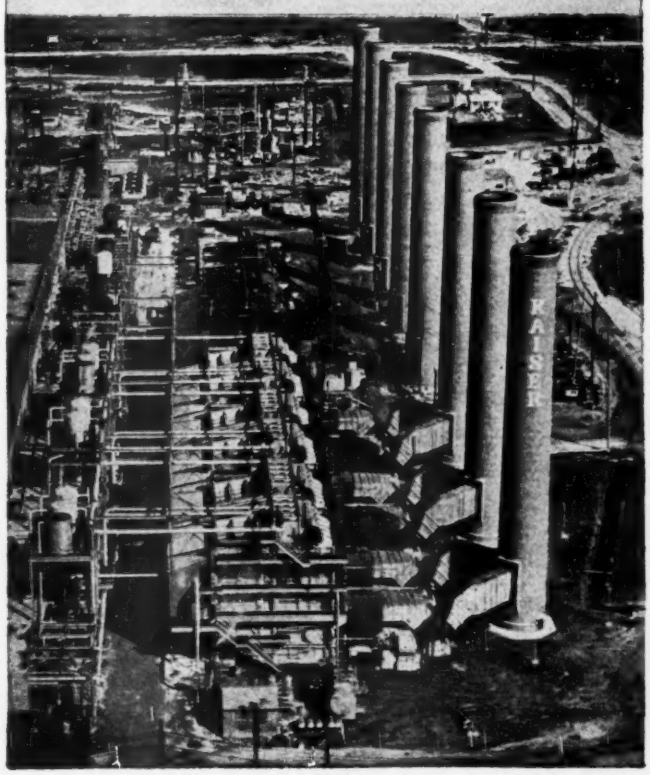
LJUNGSTROM AIR PREHEATERS

Four hundred million pounds of aluminum annually will be produced at the new Kaiser Aluminum & Chemical Corporation plant at Chalmette, La., when it is operating at full capacity. Designed and built by Kaiser Engineers, Division of Henry J. Kaiser Company, this plant will help meet the ever growing demand for aluminum products, both civilian and military.

Because it takes roughly 10 kwh of electricity to produce one pound of aluminum, the electrical generating capacity at this large new plant must be enormous. Therefore, when the plant is completed, it will have a total capacity of nearly 500,000 kw, of which 375,000 kw will be steam-generated.

The plant's vast steam requirements are met by fifteen Foster Wheeler steam generators, each with a maximum continuous capacity of 225,000 lb of steam per hr at 900 psi and 905 F. Each boiler incorporates a Ljungstrom Air Preheater, which cools exit gas to 320 F, and preheats incoming combustion air to 540 F.

The Ljungstrom Air Preheater—chosen again and again where steam generation must be efficient—can serve you, too. Its wide acceptance by utilities . . . by consultants . . . by industrial plants all over the world is your assurance that the Ljungstrom is truly the most economical heating surface on the modern boiler.



THE Air Preheater Corporation 60 East 42nd St., New York 17, N. Y.

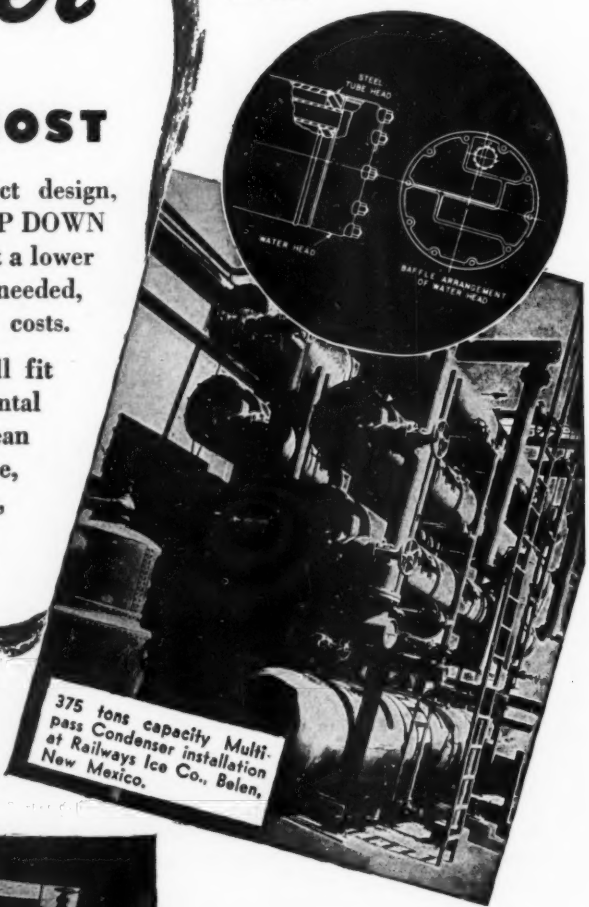
$ave Power and REFRIGERATION COST

Vogt Condensers, because of their correct design, STEP UP the rate of heat transfer and STEP DOWN head pressures. With the liquid delivered at a lower temperature, smaller compressor capacity is needed, saving in original as well as operating costs.

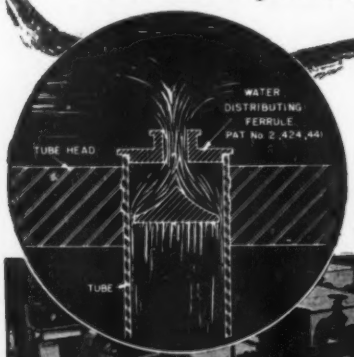
One of the two basic types illustrated will fit your operations exactly. Install Horizontal Multipass (closed type) for use with clean waters. Where the water is hard, forms scale, contains mud or promotes fungus growth, Vertical Single Pass (film type) which can be cleaned in operation, are recommended.

Horizontal Multipass Condensers
(Closed Type)

Water circulated in tubes traverses the length of the unit a number of times as determined by baffles in the heads.



375 tons capacity Multipass Condenser installation at Railways Ice Co., Belen, New Mexico.



Vertical Single Pass Condensers
(Film Type)

Patented ferrules give equal distribution of water to and over the surfaces of all tubes in a unit.

Battery of eight 42"x 16'-0" Vertical, Single Pass, Condensers at Armour and Company, National Stockyards, Illinois.

HORIZONTAL and VERTICAL TYPES SHELL and TUBE CONDENSERS For Every Service

Write For Bulletin RC-1

HENRY VOGT MACHINE COMPANY
INCORPORATED
1000 W. ORMSBY ST., LOUISVILLE 10, KY., U.S.A.
Branch Offices: NEW YORK, CHICAGO, CLEVELAND, DALLAS, PHILADELPHIA, ST. LOUIS, CHARLESTON, W. VA.

Vogt REFRIGERATION CONDENSERS

EAGLE-PICHER

One-Cote Cement

INSULATES PROTECTS FINISHES

in one quick application

ONE APPLICATION saves valuable man-hours! Whether equipment is hot or cold (above 32 F), your crew simply trowels on the white, clean-handling cement to get a smooth, light-reflectent insulating surface.

ONE APPLICATION assures high thermal efficiency at temperatures up to 1000 F. One-Cote Cement sets quickly—and when installed indoors requires no finishing treatment. In outdoor installation, a weather-protective coating is recommended.

For a cement that INSULATES—PROTECTS—FINISHES in one application, you owe yourself a thorough investigation of Eagle-Picher One-Cote. For example, one of the many plus advantages you will value is its rust-inhibitive quality—it actually protects your valuable equipment. Get *all* the facts, today!

RECOMMENDED APPLICATIONS *Valves and fittings • storage tanks • digesters • breechings • glass and ceramic kilns • stills • ovens • steam cylinders • air preheaters • hot air ducts • turbines • piping*

Since 1843

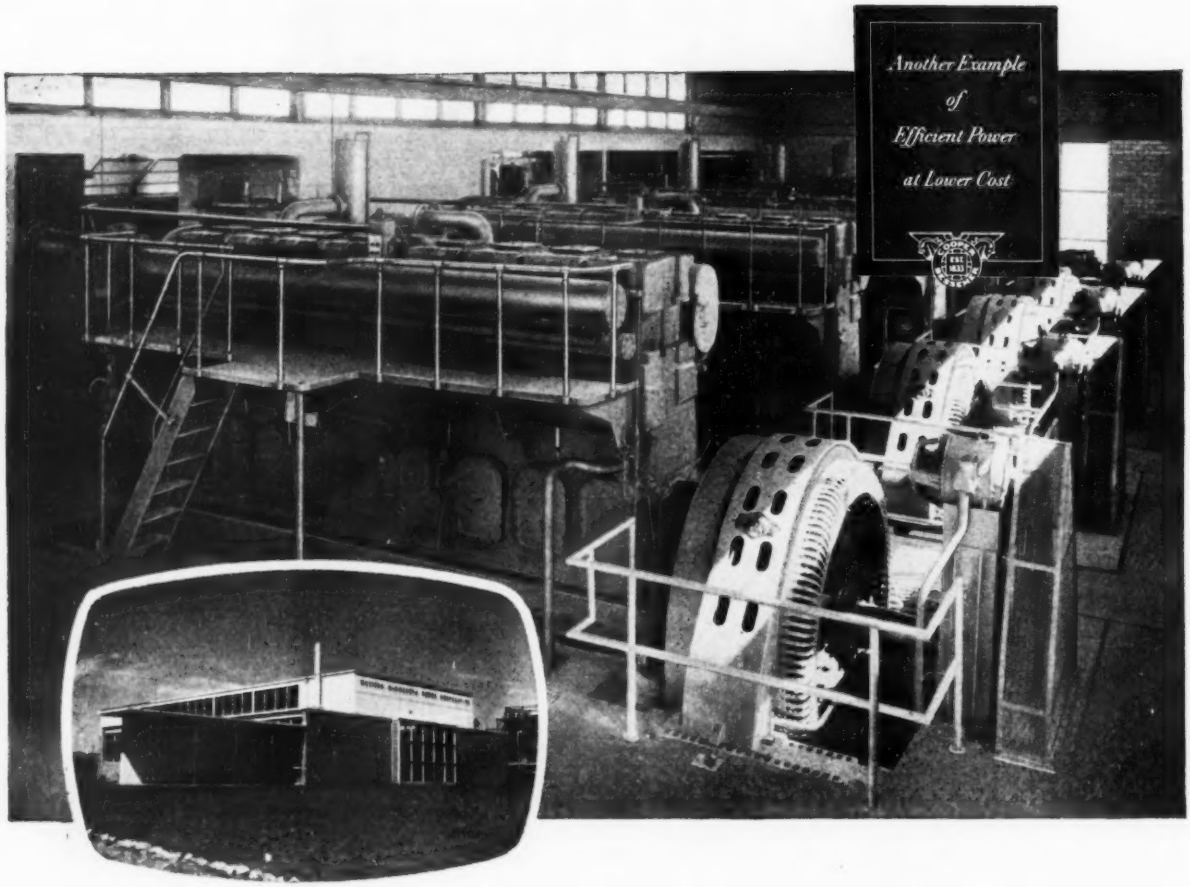
EAGLE EP PICHER

THE EAGLE-PICHER COMPANY

General Offices: Cincinnati (1), Ohio

For greater efficiency, protection and economy, specify these Eagle-Picher products:
Insulating Felts • Insulating Block • Blankets • Loose Wool • Mineral Wool Pipe Covering • Stalastic Stamastic • Insulseal • Finishing Cements • Insulating Cements • Swetchek • Insul-Stic • Fireproofing Cement

Member of Industrial Mineral Fiber Institute



How Cooper-Bessemer after-cooling saves cold cash!

WHEN a generating plant's load demand suddenly grows much greater than anticipated, it normally poses a problem! But here at Western Minnesota Power Cooperative's plant near Benson, Minnesota, Cooper-Bessemer after-coolers came to the rescue by enabling their diesels to turn out over 22% more power than originally planned.

The plant started up in 1948 with 3 of the above Cooper-Bessemer supercharged LS-8 diesels rated 1,510 hp each. Two more LS-8's, equipped with air intake after-coolers, were added later and the original 3 engines were then likewise equipped with after-coolers. So equipped, the engines are rated 1,850 hp — a total gain of 1700 hp — actually equivalent to an extra engine! Think of the saving this means in space, building, installation cost, maintenance, supervision, etc. What's more, these engines are averaging 14 kwh per gallon of fuel oil on a 50% load factor.

When you're in need of power . . . remember . . . there's one sure way to cinch lasting economy . . . Cooper-Bessemer.

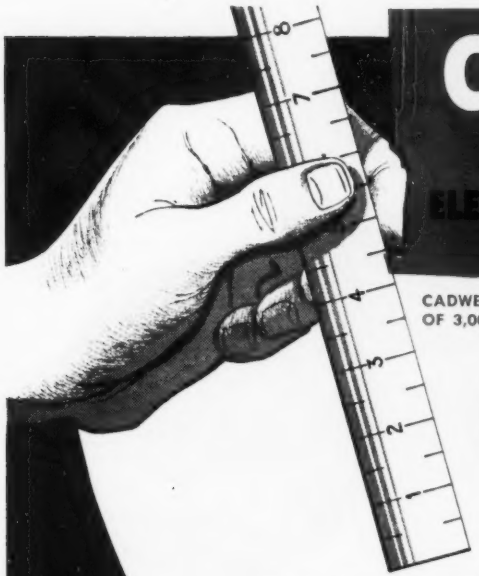
The Cooper-Bessemer Corporation

MOUNT VERNON, OHIO — GROVE CITY, PENNA.

New York Washington, D. C. Bradford, Pa. San Francisco Houston, Dallas, Greggton, Pampa and Odessa, Texas Seattle Tulsa Shreveport St. Louis Los Angeles Chicago Caracas, Venezuela Cooper-Bessemer of Canada, Ltd., Halifax, Nova Scotia Gloucester, Mass. New Orleans, La.

CADWELD®

... the best ELECTRICAL CONNECTION



CADWELD SPLICE
OF 3,000 MCM CABLE

CROSS SECTION
CADWELD SPLICE
3,000 MCM CABLE

FOR any type connection, straight splice, Tee's, Y's, crosses, etc, of any size, #8 wire through 3000 MCM cable. Also bus, tubular bus or any electrical connection of copper to copper or copper to steel.

why?

1. Greater current carrying capacity than the cable itself.
2. Cannot loosen.
3. Cannot corrode.
4. Cannot burn up or melt out.
5. Able to withstand surge currents.
6. Every strand is welded into the solid copper mass.
7. Easy to insulate because of small outer dimensions.
8. Requires no outside source of power.
9. Made with portable equipment—excellent for field use.

Send Coupon for FREE CADWELD ELECTRICAL CONNECTION CATALOG

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☐ Send CADWELD ELECTRICAL CATALOG and place my name on permanent mailing list.

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NAME _____ POSITION _____

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WARREN PUMPS

keep their heads!

. . . . . in other words, *maintained efficiency* has always been, and will continue to be, a fundamental virtue of all Warren Pumps. *Original* efficiencies in a pump can be very misleading and a source of disappointment in its long range efficient life expectancy.

The three most important factors affecting maintained efficiency are hydraulic design, leakage losses and friction losses. The generous acceptance of Warren Pumps for well over half a century is convincing evidence that Warren has the engineering ability, skilled pump mechanics, and plant facilities to handle all of these important factors to the definite advantage of their customers, from the angle of longe-range efficiency, minimum wear, and low power costs.

"THEY KEEP THEIR HEADS"

WARREN STEAM PUMP COMPANY, INC.
WARREN, MASSACHUSETTS

G-1

WARREN QUIMBY PUMPS

WARREN PUMPS

CENTRIFUGAL • RECIPROCATING • ROTARY

Quick and

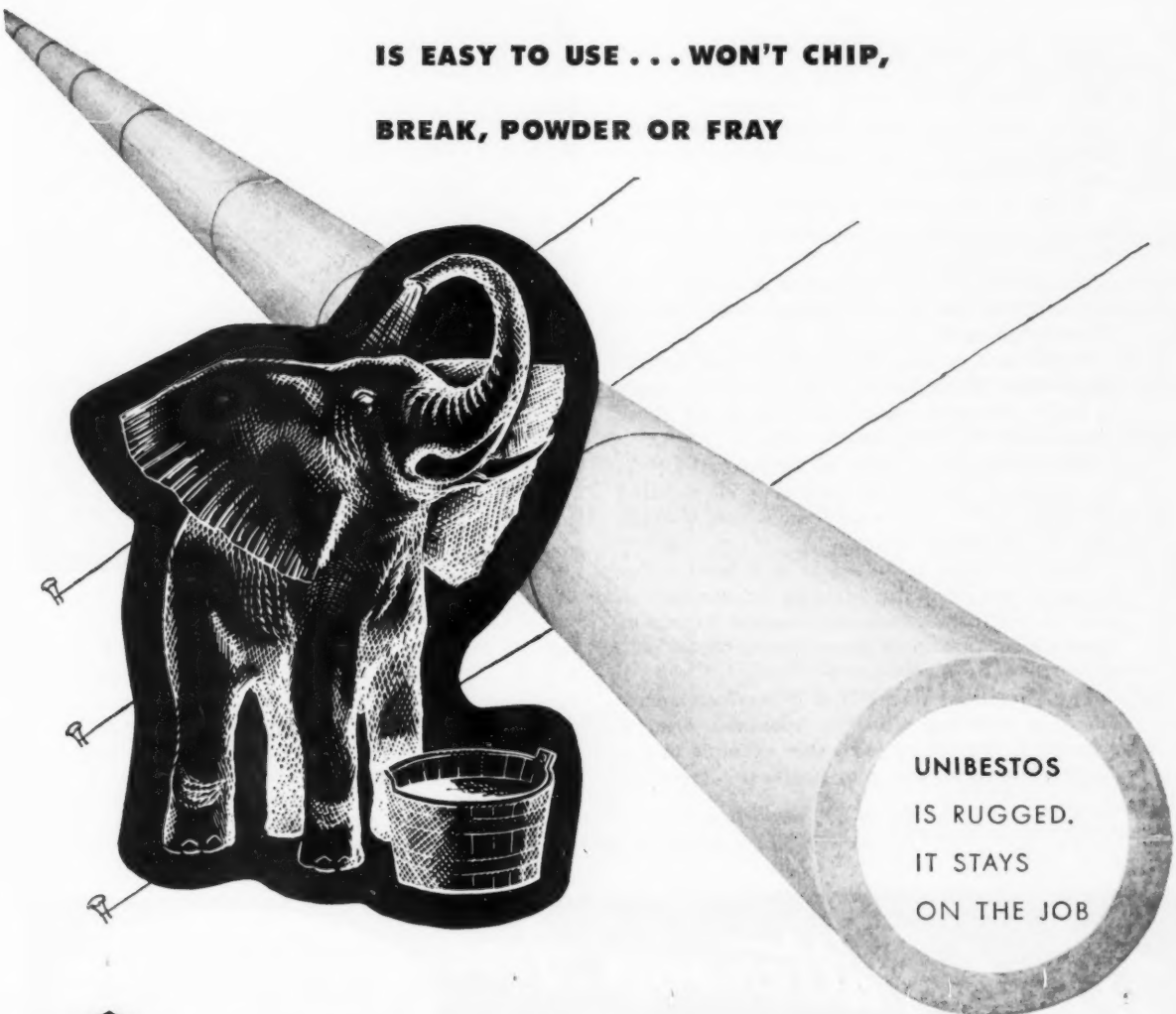
clean to apply

UNIBESTOS®

PIPE INSULATION

IS EASY TO USE . . . WON'T CHIP,

BREAK, POWDER OR FRAY

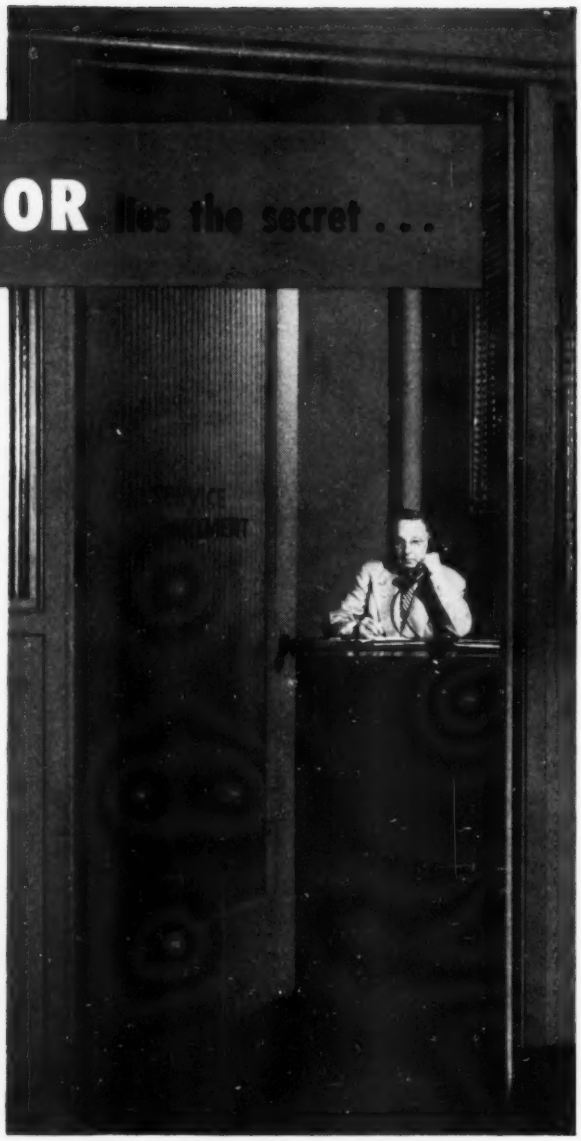


UNARCO

UNION ASBESTOS & RUBBER COMPANY

DEPT. C-8, 332 SOUTH MICHIGAN AVENUE, CHICAGO 4, ILLINOIS

BEHIND THIS DOOR lies the secret . . .



of why your Heyl & Patterson Heavy Bulk Materials Handling Installation will last . . . and last . . . and last

Since 1887 Heyl & Patterson has designed, fabricated and erected well over 3000 Heavy Bulk Materials Handling installations of all types . . . from coal tipples to complete coal preparation plants . . . from pig casting machines to mammoth ore bridges.

Today the great majority of these installations are still in operation, including many that were built 50 to 65 years ago.

The H & P Service Department is an important factor in the consistent long life of all Heyl & Patterson installations.

Night or day, the Heyl & Patterson Service Department is prepared to go all out to supply H & P customers with replacement and spare parts in the shortest possible time.

This on-the-spot service is facilitated by Heyl & Patterson's system of recording all detailed drawings on 70 mm microfilm, which is available at a moment's notice.

Time and time again the H & P Service Department has done the "next to impossible" to keep H & P installations in operation. Letters of thanks from customers prove this to be the rule rather than the exception.

The operations of the H & P Service Department in working with the customer after a contract is completed is another example of the "follow-through" that your business receives at Heyl & Patterson . . . the "follow-through" that is possible because we have our own Engineering Department, our own Research Department, our own Machine Shop, our own Structural Shop, our own Erection Department and our own SERVICE DEPARTMENT.

All H & P departments work together to provide you with the world's finest Heavy Bulk Materials Handling Equipment.

Heyl & Patterson, Inc.

"SINCE 1887"

55 WATER STREET · PITTSBURGH 22, PA.

Heavy Bulk Materials Handling Equipment

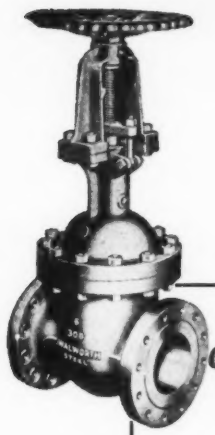
All The Way from Design to Erection

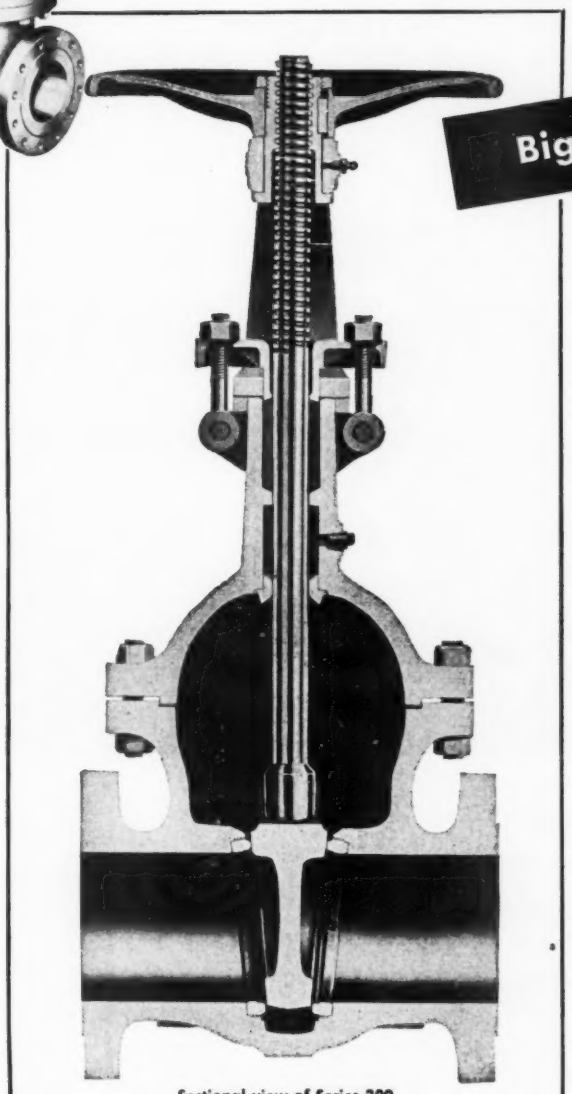
WALWORTH

Cast Steel Gate Valves

Series 150 and 300

Wedge Gate — Outside Screw and Yoke





Sectional view of Series 300

Big 8-Point Superiority!

Gland clearances are such that stem cannot be scored if gland should be tightened unevenly.

Deep Stuffing Boxes in all sizes (2″ to 24″) insure tightness and maximum packing life – costly leaks are eliminated.

Bonnets and Bodies are engineered to withstand pressure and minimize distortion – they're tough, durable, dependable.

Heavy Steel Walls provide extra strength and longer life.

Integral Body Guide Rib Faces are machined to insure accurate disc seating.

Seat Rings are bottom seated – not flange type. No recess exists at back of ring – hence no turbulence, erosion, or pressure drop.

Streamlined Ports allow high velocity, non-turbulent flow, and reduce the possibility of erosion.

Valves regularly have flanged ends. They can be supplied with ends for butt welding. Roller bearing yokes are available. On valves 5 inches and larger, by-passes can be furnished.

For Series 600 and higher, we recommend Walworth Pressure-Seal Steel Gate Valves.

For further information on Walworth Cast Steel Gate Valves, see your local Walworth distributor, or write:

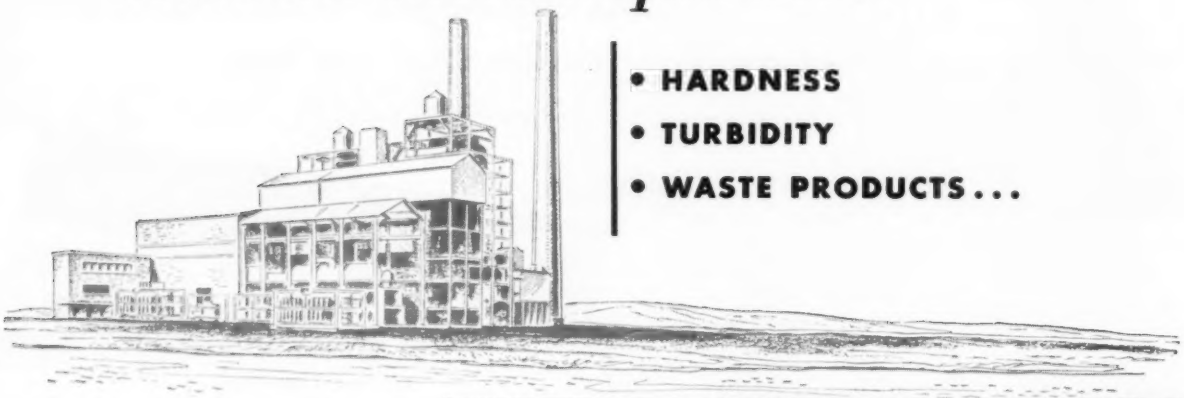
WALWORTH

valves and fittings

60 EAST 42nd STREET, NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

Raw Water Supply with all these impurities:

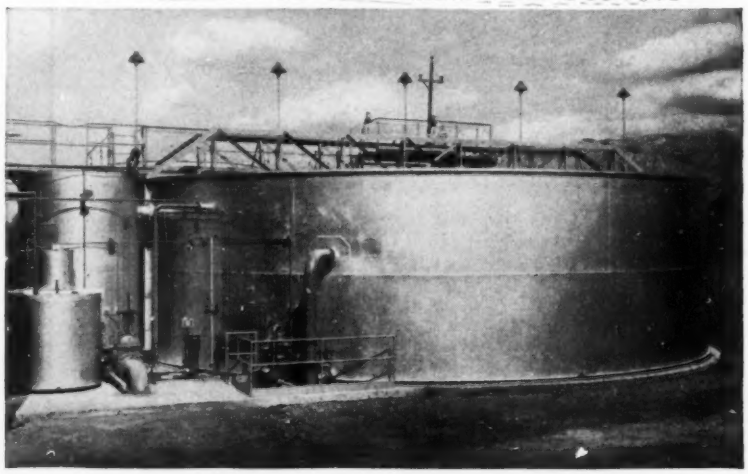


- **HARDNESS**
- **TURBIDITY**
- **WASTE PRODUCTS...**

softened and clarified by a

GRAVER Reactivator

at Utah Power & Light Co.



This raw water supply is poor... very poor...

- ***The total hardness ranges from 350 ppm to 700 ppm.***
- ***The turbidity may reach 1200 ppm.***
- ***It may contain sugar beet pulp and various other vegetable and animal wastes.***
- ***The organic pollution is so high that chlorine pretreatment is required.***

The raw water is used for the cooling tower make-up. The Graver engineers were consulted, and a 3000 gpm Graver Reactivator designed to reduce total hardness to 250 ppm and turbidity to less than 10 ppm was installed.

All over the country, central power generating stations, industrial plants and municipalities are being served by Graver water conditioning equipment to meet individual softening and clarifying requirements.

Write for bulletin describing Graver units in detail, and be sure to consult Graver before purchasing any water conditioning equipment.

Graver Reactivator at Gadsby Plant of Utah Power & Light Co. Also in this plant the make-up for a boiler with a capacity of 620,000 pounds of steam per hour goes through Graver Filters and Automatic Zeolite Softeners which reduce the hardness to zero before passing to evaporators.

GRAVER WATER CONDITIONING CO.

Division of Graver Tank & Mfg. Co., Inc.

DEPT. P-R, 216 WEST 14TH STREET, NEW YORK 11, N. Y.

IN CANADA: The Bird-Archer Co., Ltd.; Cobourg, Ontario

IN MEXICO: Proveedores Tecnicos, S. A.; Puebla 259, Mexico 7, D. F.

GRAVER

GW 488

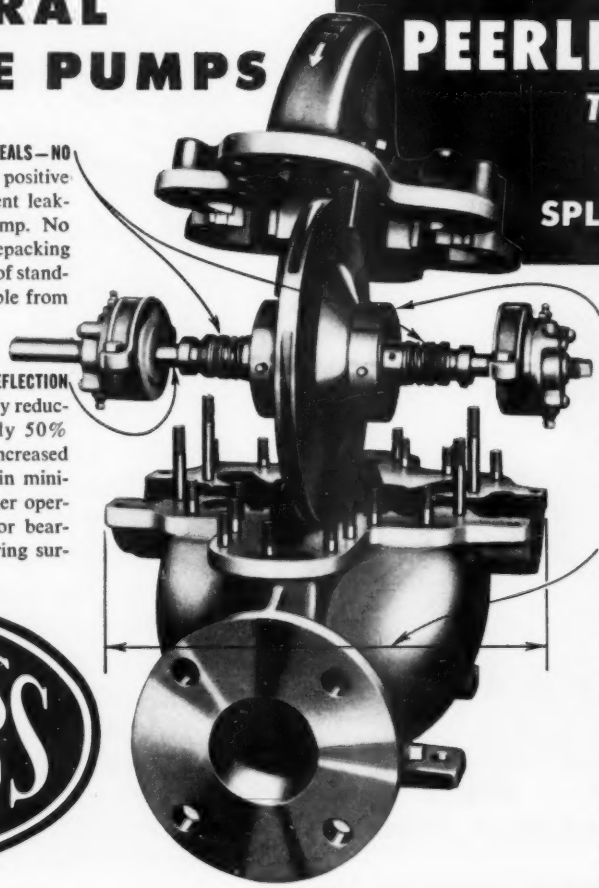
A NEW DESIGN

IN GENERAL PURPOSE PUMPS

PEERLESS *Type* AS HORIZONTAL SPLIT CASE PUMP

USES MECHANICAL SHAFT SEALS—NO STUFFING BOXES. Single positive acting, shaft seals prevent leakage of liquid from pump. No more down-time for repacking stuffing boxes. Seals are of standard design easily available from commercial sources.

SHORT SHAFT AND LESS DEFLECTION MEANS LONGER PUMP LIFE. By reducing shaft length nearly 50% Peerless has effectively increased shaft rigidity, resulting in minimum deflection, smoother operation and longer life for bearings, seals and all wearing surfaces.

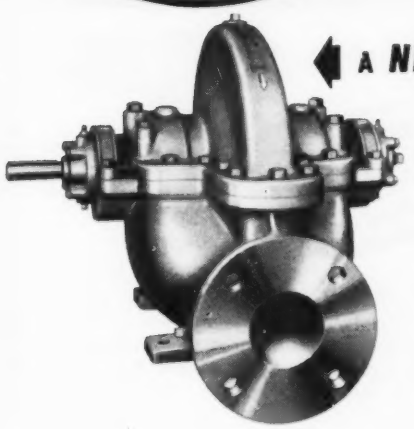


ENTIRE ROTATING ELEMENT LIFTS OUT AS A UNIT FOR EASY MAINTENANCE. Inspection or maintenance can be performed without disturbing piping connections or pump alignment. All parts on shaft can be removed with standard tools, on the job.

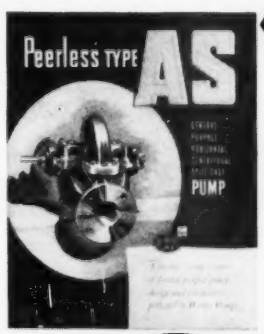
OCCUPIES HALF THE SPACE OF CONVENTIONAL DESIGNS. Floor space saving is made possible by elimination of packing gland housings. Provides more room for accessibility to piping, valves and control equipment.

CUSTOM PUMP—STANDARD PRICE. Type AS pumps cost no more than ordinary split-case pumps. Yet you get extra quality, without paying a premium. Proved in service.

PEERLESS PUMPS



A *NEW* PUMP DESIGNED AROUND MECHANICAL SHAFT SEALS



A *NEW* BULLETIN
that completely describes its advantages

Write for Bulletin No. B-1350 which completely describes and illustrates the modern design and construction features of Peerless Type AS pumps.

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION
301 West Avenue 26, Los Angeles 31, California

Please send us a copy of Bulletin No. B-1350 describing Peerless Type AS Pumps.

NAME_____

COMPANY_____

ADDRESS_____

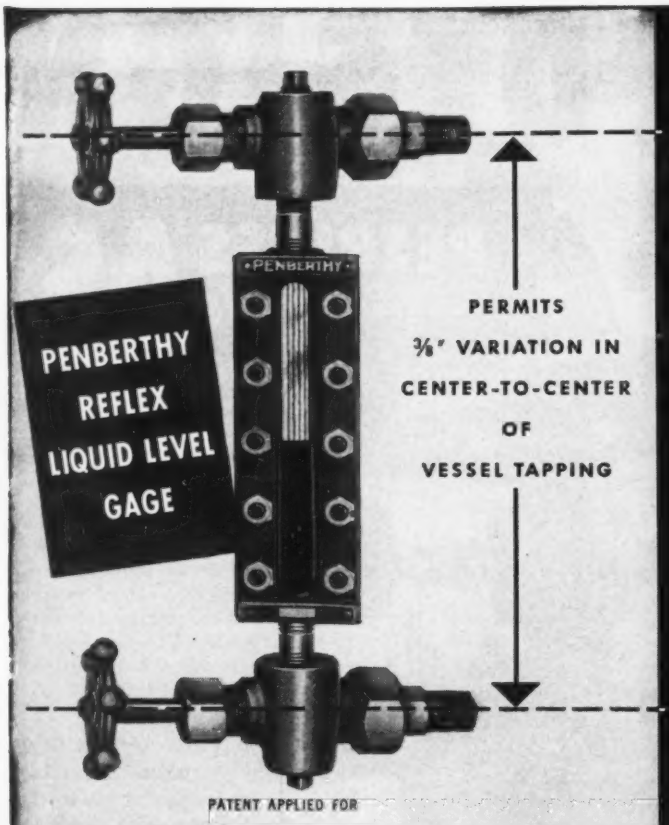
CITY_____ STATE_____

POW.

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION
Factories: Los Angeles, Calif. and Indianapolis, Indiana.
Offices: New York; Atlanta; Chicago; St. Louis; Indianapolis; Phoenix; Fresno; Los Angeles; Tulsa; Dallas, Plainview, and Lubbock, Texas; Albuquerque, New Mexico.
Distributors in Principal Cities; Consult your Telephone Directory.

PEERLESS PUMPS

fmc


PENBERTHY
PENBERTHY REFLEX LIQUID LEVEL GAGE
PERMITS 3/8" VARIATION IN CENTER-TO-CENTER OF VESSEL TAPPING
PATENT APPLIED FOR

PENBERTHY "Floating Shank"

Saves Time and Money in Gage Installation

A feature available only on Penberthy drop forged steel (and alloy) gage valves, the "floating shank" automatically compensates for as much as 3/8" variation in the center-to-center distance of the vessel tapping. This saves time and cuts the cost of gage installation . . . eliminates stresses often induced during mounting. Penberthy "floating shank" is available at slight additional cost. It will pay you well to specify "floating shank" on your next gage order.

Another PENBERTHY First

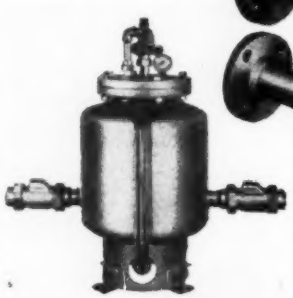
OTHER PENBERTHY PRODUCTS

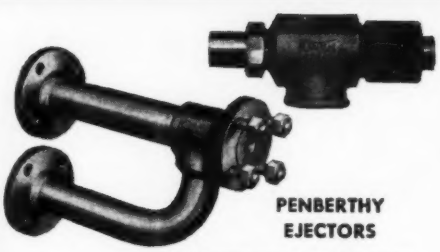
PENBERTHY TRANSPARENT GAGE

Used to observe color and density of liquids under high pressures and/or temperatures. Exceptionally sturdy construction—liquid chamber machined from solid block of metal. Ask for Catalog 35.

PENBERTHY CYCLING JET PUMPS

Automatically operated by air, gas or steam pressure . . . Will pump without clogging any liquid that will flow through pipes. Ask for Bulletin 5030.





PENBERTHY EJECTORS

A simple jet pump operated by air, water or steam. Needs no lubrication . . . will not get out of order. Made in wide variety of materials and special units developed to meet unusual conditions. Ask for Bulletin 512.

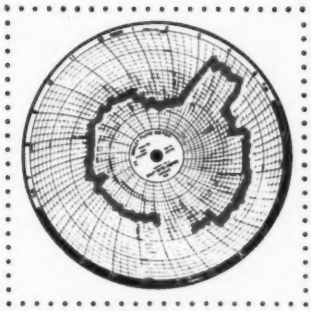
4671

PENBERTHY INJECTOR COMPANY

DIVISION OF THE BUFFALO-ECLIPSE CORPORATION

DETROIT 2, MICHIGAN

Established 1886 — *Canadian Plant, Windsor, Ontario*



another major utility

KEARNY Generating Station

Public Service Electric and Gas Co.

SELECTS PEABODY

Public Service Electric and Gas Company, keeping pace with the rapidly progressing power generation field, recently placed their new Kearney #7 unit in service. This unit is the *first* to use steam temperature of as high as 1100 F and turbine throttle pressure of 2350 PSI. Provided with Peabody Wide Range Mechanical Atomizers and Constant Differential Pump Systems, this Kearny Unit is getting a load range of 7 to 1 – with all burners in service and no changing of tips!

OFFICES IN PRINCIPAL CITIES

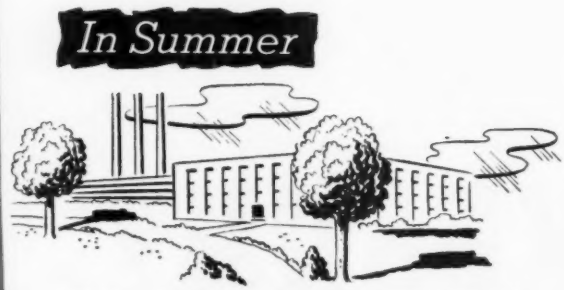
PEABODY
ENGINEERING CORPORATION
580 FIFTH AVENUE • NEW YORK 36, N. Y.
Manufacturers of all types of combustion equipment, direct-fired air heaters, gas scrubbers, coolers, and absorbers

514

PEABODY LIMITED • LONDON, S.W. 15, ENGLAND

CLARAGE *Multitherm*
AIR CONDITIONING UNITS

THEY HEAT AND HUMIDIFY



THEY COOL AND DEHUMIDIFY

. . . . *year-'round comfort at low cost*

Clarage Multitherm Conditioning Units are double duty machines. They keep your place cool and dehumidified in summer. They heat and humidify in the wintertime.

You save considerable in cost by having the same equipment working for you the year-'round . . . and every day you're assured of comfortable working conditions.

Multitherm Units come in vertical and horizontal types as shown—ten sizes—capacities 600 to 20,500 c.f.m. You use a direct expansion refrigerant, cold water or brine for cooling; steam or hot water for heating.

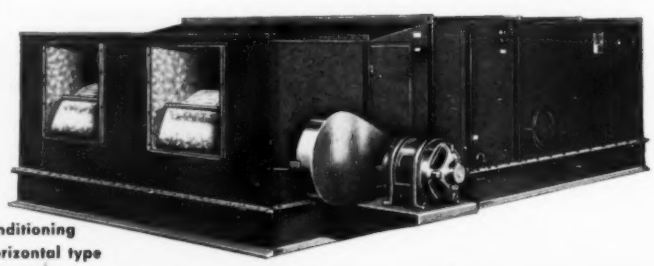
Multitherm Conditioning Unit—vertical type

. . . . *or process conditioning*

Aside from comfort applications in offices, plants, stores, etc., Multitherm Units are widely used in industry where production depends upon a certain temperature and humidity. Clarage Capillary Conditioners are available for cases where extremely close control is needed to meet requirements.

We welcome your inquiry for any desired information.

CLARAGE FAN COMPANY
Kalamazoo, Mich.



Capillary Conditioning Unit—horizontal type

You can Rely on . . .

CLARAGE

Headquarters for Air Handling and Conditioning Equipment

SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES • IN CANADA: Canada Fans, Ltd., 4285 Richelieu St., Montreal

Any way you look at it this Thermometer is *Easy Reading*

You've been asking for a dial thermometer like this—A thermometer that can be positioned and firmly locked at any practical angle—now you can have it!

No stretching or straining to see this thermometer. Easy to adjust to required new positions before or after installation. No risk of the multi-angle selector working loose. A specially designed selector assures positive locking at every practical mounting angle and a few turns of *one* nut lock the selector securely.

These instruments, supplementing USG's complete line of Gotham temperature indicators, are designed to fit all standard connections and are available in all standard ranges. If you have a number of applications requiring "odd angle" mounting these new multi-angle thermometers will reduce the number and variety of instruments you have to carry in stock.

Before you order an angle thermometer be sure you see USG's new Gotham Multi-Angle Thermometer.

UNITED STATES GAUGE

ADVANTAGES

1. Positive locking in every conceivable angle.
2. Reduces the number and variety of instruments required in your maintenance stock.
3. Provides that extra "odd angle" instrument which normal stock does not furnish.
4. Easy to change to any desired angle, before or after installation.
5. Saves engineers time when writing specifications.
6. Affords easy reading at odd angles.

United States Gauge
Division of American Machine and Metals, Inc.
Sellersville, 4, Pa.
Gentlemen:
We'd like to know more about the new USG Multi-angle Thermometer. Please get in touch with us.

Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____

INDUSTRY'S MAGIC WORD FOR THIS YEAR...

Modern

...AND HERE IS A BIG, EXTRA SERVICE

TO HELP YOU MAKE

When POWER's editors saw indications of a change in the direction of industry spending—from new plant to plant modernization—they started planning on how to make the most of this trend for POWER's 45,000 readers.

They went straight into the field—asking key men about *modernization*—about plans and problems. They hit a magic word, for power-field men went after this subject like

Power's

MODERN PLANT HANDBOOK

to be published

A LONG-LIVED SERVICE FOR 45,000

ize

FROM *Power*

THE MOST OF IT

a hungry trout after a fly. Readers in all parts of the country have responded enthusiastically with good, practical working suggestions, meaty comment and thoughtful opinion.

Truly, "Modernize" is the magic word for this year. And POWER's Modern Plant Handbook issue is edited to serve the trend with utmost usefulness, and to provide reference material available nowhere else.

ISSUE

September 15, 1953

Power ENGINEERS

THESE CONTENTS HOLD EDITORIAL AND ADVERTISING VALUES WORTH YOUR MOST CAREFUL ANALYZING

MODERN PLANT SURVEY

Already well-known to power-field men. Will contain tabulated technical data on over 500 new steam and hydro plants.

RENOVATION ROUNDUP

200 ideas to cut costs and promote efficiency in plant modernization programs.

DIRECTORY OF POWER-FIELD MANUFACTURERS

Over 600 product listings. Names and addresses of more than 1,000 manufacturers. The only directory of power-field equipment and who makes it.

CROSS FILE OF OBSOLESCENCE

Names of former manufacturers, matched with successor company's name. Invaluable in any program where obsolete equipment is being replaced.

THE SHOW CASE

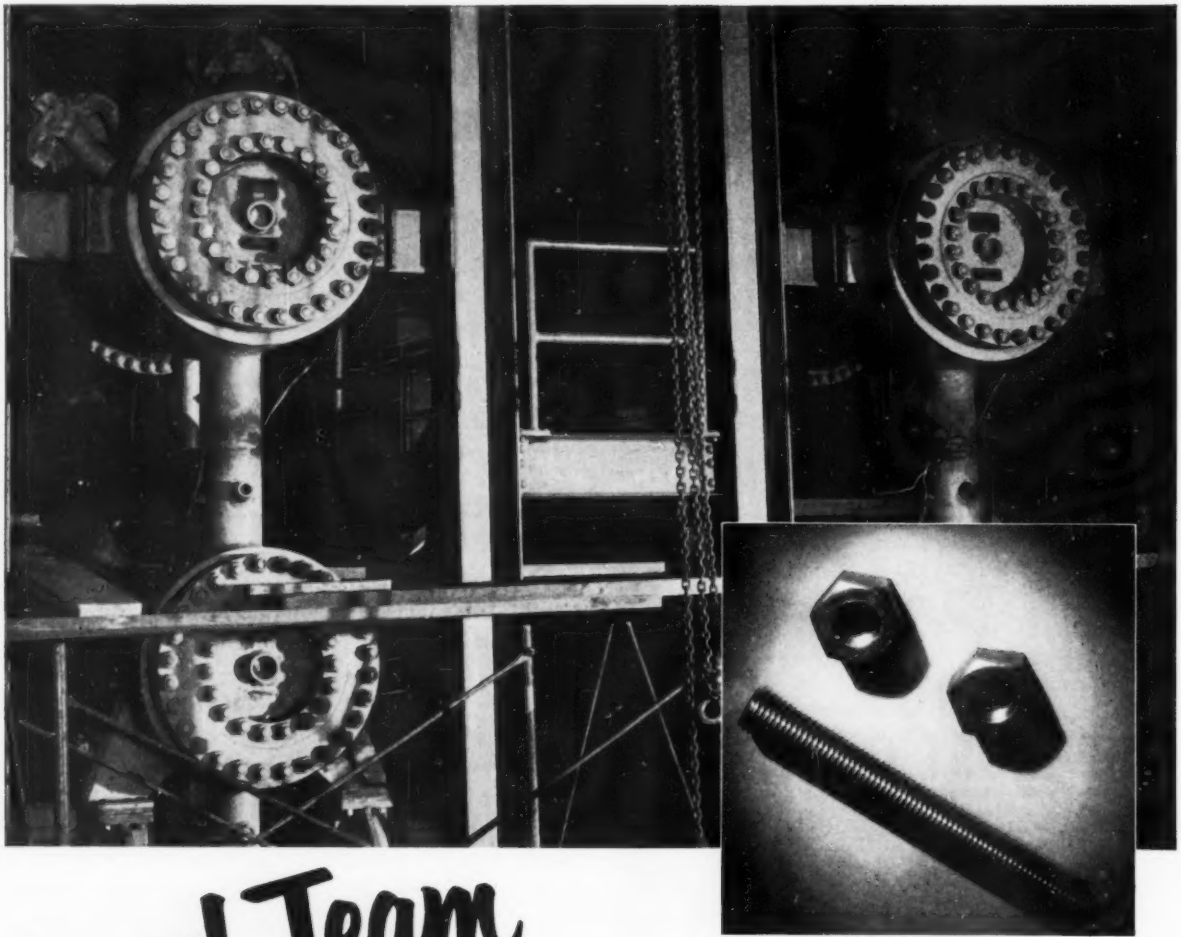
New Products. Names of manufacturers. Double order cards for readers' convenience in getting further information.

—the most complete and timely information you can get on

MODERNIZATION

in the power field is in the Handbook—the 15th of next month.

WATCH FOR IT!



Good Team for High-Temperature Bolting

Here's a high-temperature, high-pressure fastener team that you can use with confidence. It consists of the Bethlehem Continuous-Thread Stud and two Bethlehem Quenched Nuts. It resists premature failure caused by high temperatures and pressures; it is economical, too, because it minimizes down-time.

With the Bethlehem Continuous-Thread Stud, stress-concentrations are unlikely to occur. This is because the stud has no point of thread-runout. Instead of converging at any one point to cause premature failure, stresses are distributed along the full working length of the stud. The stud is manufactured from carbon or alloy steel, and is furnished plain or heat-treated.

The Bethlehem Quenched Nut is made from .40-to-.50 carbon steel by forging and extruding hot steel in a forming die, then quenching and tempering. This method of manufacture arms the nut with sufficient stamina to develop the full strength of any stud or bolt.

If you have any questions about the use of fasteners in high-temperature, high-pressure service, put them up to Bethlehem. A letter addressed to the nearest Bethlehem office will bring a representative to your desk promptly.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

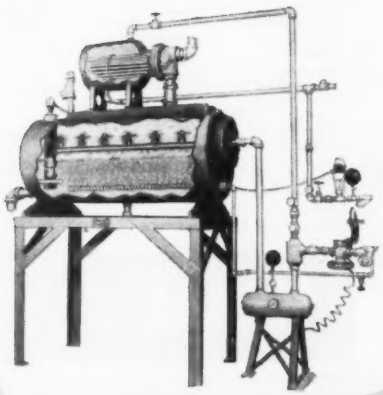
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

Bethlehem supplies every type of Fastener

a Fresh approach . . . a Major advance . . .

in boiler feedwater deaeration



SCHAUB ZERO-OXYGEN Deaerators

NEW DESIGN! NEW PERFORMANCE! NEW SAVINGS!

Complete Oxygen Removal (to .005 cc/liter) • Complete Safety and Dependability • Wide Range for Load Variations • High Thermal Economy • Low Maintenance Costs • Simpler Design for Trouble-Free Service

Start with an idea that's *basically* new and better. Then produce performance beyond the best that ordinary deaerators can deliver. Schaub engineers achieved it . . . developed the all-new deaerator that's a major advance in boiler feedwater deaeration!

Two basic differences give the Schaub Zero-Oxygen Deaerator its outstanding advantages . . . note them well. First, it provides *external* pre-heating to a temperature *above* boiling point, with over-atmospheric pressure held only up to the internal sprayer manifold! Second, a free, non-restricted vent liberates *all* air *immediately* with maximum vapor heat recovery!

From these simple fundamentals stems a whole series of all-important performance benefits. Every engineer or operating man concerned with boiler feedwater deaeration should have the full facts on all-new Schaub Zero-Oxygen Deaerators. Simply send the coupon to get the complete story — promptly.

FRED H. SCHAUB ENGINEERING COMPANY

2105 South Marshall Boulevard • Chicago 23, Illinois

FREE FACTS!
SEND COUPON TODAY
FOR BULLETIN 575

Tells why you need deaeration. Explains basic differences in deaeration systems. Here's the complete story on new Schaub Zero-Oxygen Deaerators.

FRED H. SCHAUB ENGINEERING COMPANY
2105 South Marshall Boulevard, Chicago 23, Illinois

Please send me without cost or obligation, my personal copy of your new bulletin 575 on Boiler Feedwater Deaeration.

NAME_____

COMPANY_____

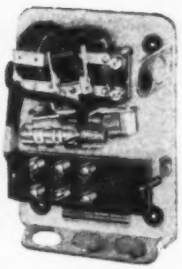
ADDRESS_____

CITY_____ ZONE____ STATE_____

MERCOID

TRANSFORMER-RELAYS

FOR VOLTAGES UP TO 550V. A.C. or D.C.



NO SPRINGS OR CLAPPERS

NO WELDING OF CONTACTS

NO MAINTENANCE REQUIRED

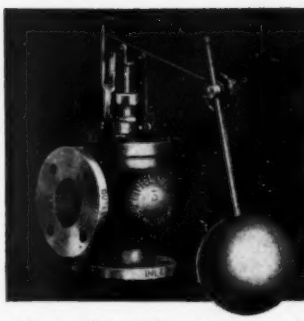
UNAFFECTED BY DUST, DIRT OR PITTING

ENGINEERED FOR LONG OPERATING PERIODS

Recommended for all applications requiring a very quiet and dependable mercury switch relay with low voltage pilot circuit. Available in many circuit arrangements. Our engineering staff will gladly assist in the adaptation of a Mercoid Relay for your particular problem.

Write for Catalog No. 700R

THE MERCOID CORPORATION, 4201 BELMONT AVE., CHICAGO, ILL.



FLOAT VALVES

No. 77 illustrated — Single seated float valve for dead end service. Internal pilot control. 250 lbs. max. inlet pressure. Does the job of more complicated control valves at a much lower cost wherever tight closing float valves are required for make-up water control. Sizes 2" — 8". Other types. Get BULLETIN 349.

Call Your Supply House or See Classified Phone Directories for Nearest Klipfel Distributor.

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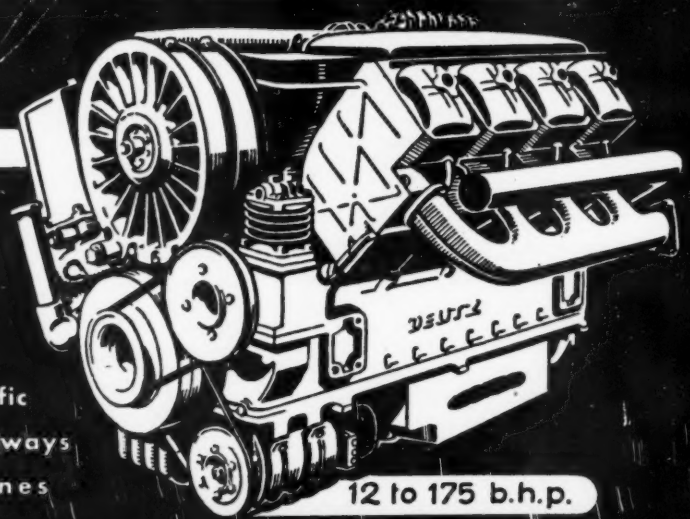
K-139

Klipfel VALVES, INC.
HAMILTON, OHIO

DEUTZ

Diesel

air cooled



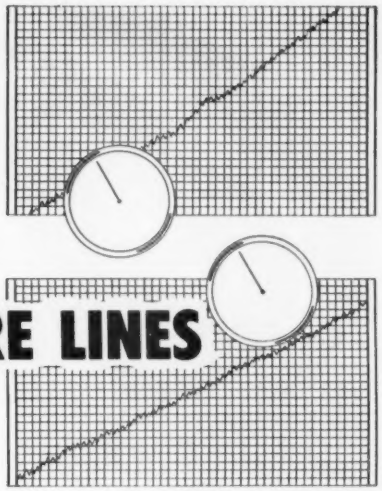
for
road and rail traffic
ships on all water-ways
working machines
for all applications

12 to 175 b.h.p.

KLÖCKNER-HUMBOLDT-DEUTZ AG · KÖLN

GERMANY

For worry-free HIGH PRESSURE, HIGH TEMPERATURE LINES



you need that *Extra Margin of Safety* that *ONLY* Seamless provides!

WATCHING gages won't solve your problems. Nor lessen your responsibility as plant engineer for safeguarding equipment, and eliminating costly shutdowns that could result from the failure of your steam lines.

In dealing with today's mounting pressures and temperatures, you can have real peace of mind *only* when you have complete confidence in your power pipe and tubes. If you *know* that they are free from potential sources of weakness, you can face the severest operating conditions with assurance.

NATIONAL Seamless with its famous "Walls without Welds" has never been surpassed for power plant service. Pierced from a billet of high quality steel it has the strength, uniformity and dependability of a solid forging. Every length is an homogeneous steel cylinder. It has no welds, no line of potential weakness to limit safe operating pressures.

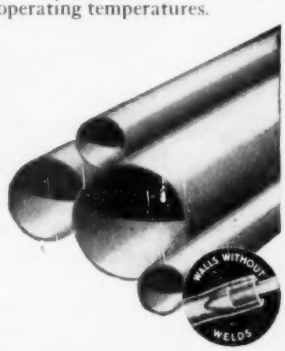
Made to the detailed requirements of recognized standard specifications and carefully tested and inspected before shipment, it comes to you structurally sound from end to end.

NATIONAL Seamless Pipe and Tubes promise smooth installation

Countless installations all over the country—many under the most severe operating conditions, are convincingly demonstrating the outstanding fabrication qualities of NATIONAL Seamless Pipe and Tubes. Power Plant Designers have found that when specifying NATIONAL for their power plant requirements it has the strength to meet any specifications; that it meets all requirements for flanging, bending, expanding, coiling, and similar purposes; that it is available in many grades of steel—from carbon to alloy steel and stainless—to assure maximum creep strength for actual or anticipated operating temperatures.

These FREE data books will help you

For more information about NATIONAL Seamless Pipe and Tubes for power plants, write for Bulletin Number 26 which contains interesting technical data concerning the properties of steels employed for elevated temperatures, and Bulletin Number 10 covering high-pressure power plant piping. Address your inquiry to National Tube Division, United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa.



NATIONAL TUBE DIVISION
UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

U·S·S NATIONAL *Seamless* PIPE AND TUBES

UNITED STATES STEEL

air is expensive

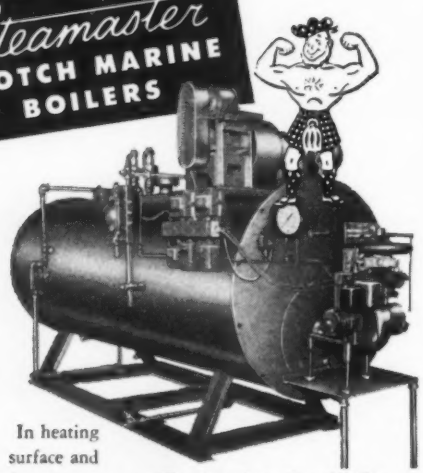
IN THE WRONG PLACE

Air mixed with the steam in your heaters or coils is expensive because it retards heat transfer and lowers steam temperature. Remove air from steam heated machines with ***Sarco thermostatic air vents.*** Write for Bulletin 276 and the name of the Sarco man nearest you. He can help you select the best vent for your purpose and the right place to install it.

Represented in Principal Cities **502**

SARCO SARCO COMPANY, INC.
Empire State Bldg., New York 1, N.Y.
SAVES STEAM SARCO CANADA, LTD., TORONTO 8, ONTARIO

Steamaster
SCOTCH MARINE BOILERS

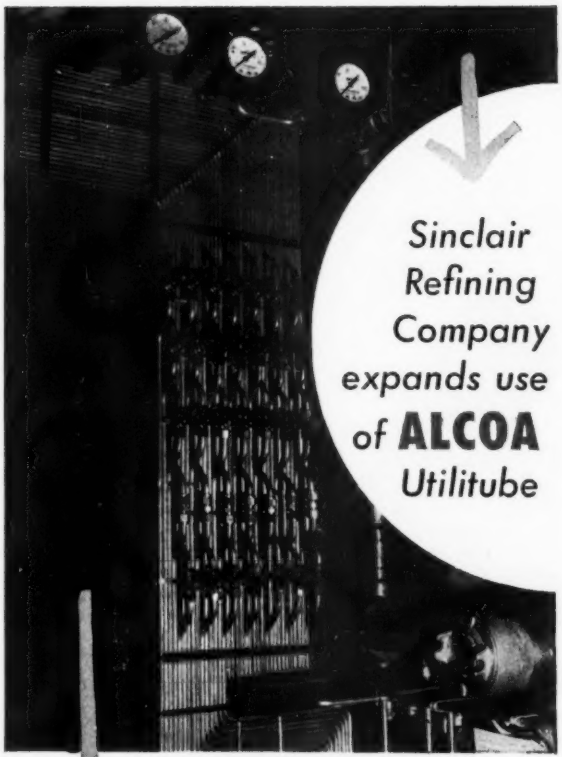


In heating surface and service, you get more for your money... an exceptional 7 to 8 sq. ft. heating surface per boiler hp.

- Ten sizes from 3 to 150 hp
- Passes any insurance inspection
- No lagging or brickwork
- Gas, oil or combination firing
- Natural or induced draft
- Multi-pass design saves fuel
- Submerged tubes last longer

Write, wire or phone today for a personal survey of your boiler needs.

STEAMASTER AUTOMATIC BOILER CO.
5819 Compton Ave., Los Angeles 11, California • LUcas 6226



Sinclair Refining Company expands use of **ALCOA** *Utilitube*

ALCOA Utilitube* serves air to control board instruments at Sinclair's Light Oil Treating Plant, Houston, Texas. Satisfactory operation of two other Alcoa Aluminum Coiled Tube installations prompted this new installation.

USE ALCOA UTILITUBE for fuel and lube lines, for hydraulic fluids, for air and refrigerants. It will not gum or sludge in petroleum service, nor will it discolor or contaminate the fluid it carries.

USE ALCOA UTILITUBE TO SAVE MONEY. It's the lowest cost corrosion-resistant metal tube you can buy . . . may very easily cut your tube costs by 40 per cent!

ALCOA UTILITUBE forms, flares and bends as easy as annealed copper yet work hardens less. At sub-zero temperatures it actually gets stronger!

ALCOA UTILITUBE AND FITTINGS are available from your aluminum distributor. For complete information, write for the booklet: "Alcoa Utilitube."

ALUMINUM COMPANY OF AMERICA
1004-H Alcoa Building, Pittsburgh 19, Pa.

*Registered Trademark, Aluminum Co. of America

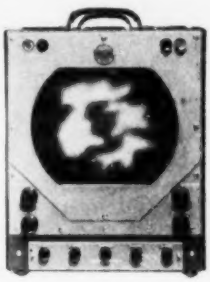
Alcoa Aluminum

ALUMINUM COMPANY OF AMERICA

TOO HOT *to approach?*

SEE IT CLOSE-UP WITH RCA INDUSTRIAL TV

Heat, cold, danger or inaccessibility need no longer hamper supervision of remote operations. Constant watch and *close control* can be maintained—safely and conveniently—with RCA Industrial TV.



Panel-mounted ITV monitors permit continuous observation of:

- **furnace combustion**
- **pilot burner operation**
- **boiler water levels**
- **smoke stack discharge**

Rugged Vidicon Tube shrinks camera size

RCA's Vidicon camera tube cuts the weight of the RCA Industrial TV camera to a mere 7½ pounds. It measures 3″ x 5″ x 10″—fits practically anywhere. And, because of the Vidicon's tough, compact construction, your RCA Industrial TV camera can handle heavy-duty jobs of all types.

High-Definition Picture for close control

With RCA Industrial TV, you attain the accuracy of direct observation without danger or inconvenience. Centralized, visual control over a number of remote or inaccessible operations is readily achieved. And, *all* camera adjustments are made at the viewing monitor. Scanning frequencies are 525 lines, 30 fields, 60 frames interlaced—the same as commercial television. With RCA Industrial TV, you see a high-definition, high-contrast picture that's ideal for close control.

Check RCA Industrial TV for workability

Check these important RCA features: 2-unit chain, 110-volt, 60-cycle AC operation—2-knob control for all normal requirements. Investigate the full line of RCA-engineered, field-proven accessories—water-cooled camera lens: shock mounting; automatic iris control; weather- and explosion-proof housings; remote panning; camera switching equipment. RCA Industrial TV can be used in extreme ambient temperatures, indoors or outdoors.

In addition, check RCA's practical Service Plan—complete nation-wide service by the RCA Service Company.

Before specifying, get full details on RCA Industrial TV. FOR INFORMATION MAIL COUPON NOW.

Industrial Products, Dept. 208T
RCA Engineering Products, Camden, N. J.
Please send me information on RCA Industrial TV.

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

RCA

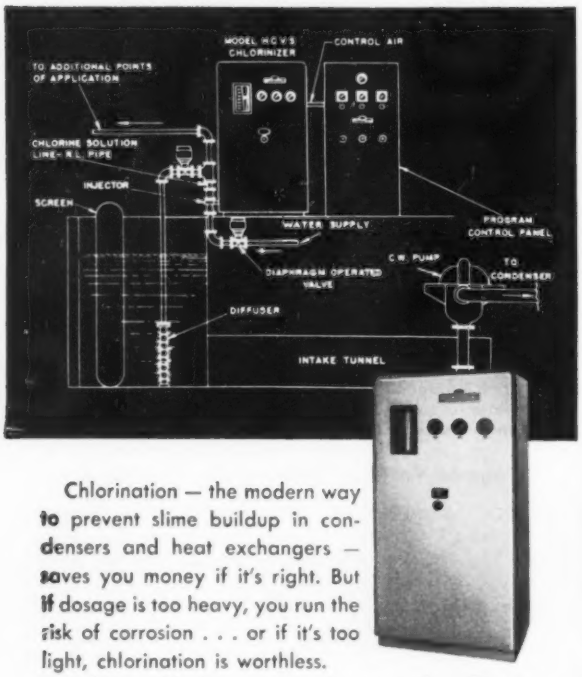
INDUSTRIAL PRODUCTS

RADIO CORPORATION of AMERICA

ENGINEERING PRODUCTS DEPARTMENT *CAMDEN, N.J.*

In Canada: RCA VICTOR Company, Limited, Montreal

Slime Control
IN COOLING SYSTEMS



Chlorination — the modern way to prevent slime buildup in condensers and heat exchangers — saves you money if it's right. But if dosage is too heavy, you run the risk of corrosion . . . or if it's too light, chlorination is worthless.

Builders Chlorinizer is the key to safe, effective, economical chlorination in cooling systems. CHLORINIZER IS ACCURATE . . . The sensitive compensating valve and the visible-flow Sightflo Indicator guarantee correct feed for effective treatment and insure against corrosion. CHLORINIZER IS SAFE . . . The full vacuum principle automatically and positively shuts off chlorine feed on loss of vacuum. CHLORINIZER IS SIMPLE . . . Because of its basic design, Chlorinizer is readily adaptable to single or multiple point applications on manual, semi-automatic, or fully automatic control.

Builders Chlorinizers are available in three volumetric models for feeding from a few pounds to 6,000 pounds per day. Send coupon for complete details.

BUILDERS-PROVIDENCE, INC.

INDUSTRIES (DIVISION OF B-I-F INDUSTRIES) BUILDERS

354 Harris Avenue, Providence 1, Rhode Island

Please send Application Memo No. 840-J9 describing Chlorinizer slime control system.

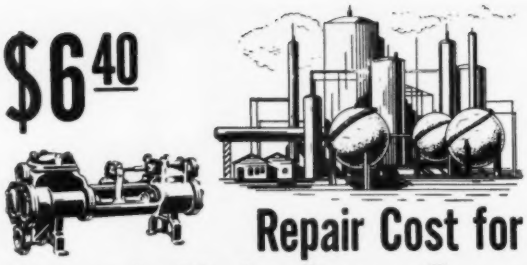
Name.....

Company.....

Street.....

City..... State.....

$6.40



Repair Cost for Valves in Sludge Burner Pump

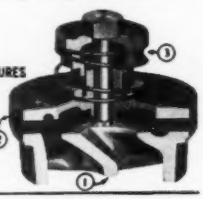
Valve parts were being replaced monthly in a large Eastern refinery. When Sims Pump Valves were installed — *guaranteed* to give longer service — *no* maintenance was necessary for over a year. Service then indicated a change in spring materials — cost: $6.40 — and an even further reduction of repairs was gained.

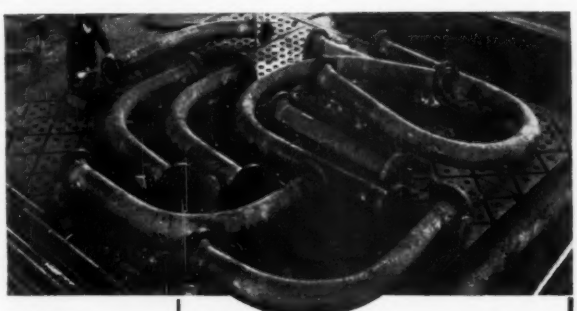
Sims Pump Valves are carried in stock for more than 40 different makes — and hundreds of sizes — of reciprocating pumps. Free catalog shows how they fit your pump, reduce maintenance, and give guaranteed better performance.

SIMS
PUMP VALVE CO., INC
1318 PARK AVE., HOBOKEN, N.J.
M & M BLDG., HOUSTON, TEXAS

...Only SIMS HAS THESE PATENTED FEATURES

1. Inclined ribs, which help increase pump capacity 20%.
2. Valve disc that rotates every time it lifts
3. Double shock-absorber stem head





10" chrome alloy pipe bends with chrome welding neck flanges.

PRE-FABRICATED PIPING READY for INSTALLATION

• Western Piping Supply's engineers can save you time and money because piping is their specialized job.

With WPS sub-assemblies, field welds are minimized; each job is engineered and built to *exact* specifications.

For superior quality piping at lowest "in-place" cost, specify WPS.

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504 WEST 145TH STREET, EAST CHICAGO, INDIANA
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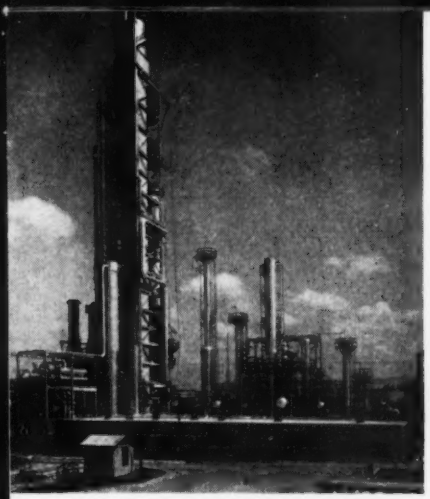
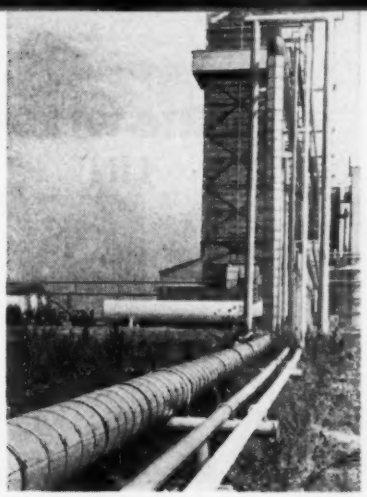
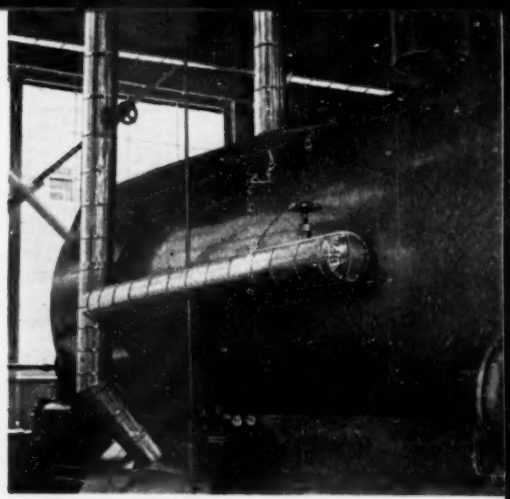


This big new Oklahoma refinery has used a new kind of aluminum jacketing throughout on both insulated lines and towers and vessels. Light in weight and low in cost, this new Childers Aluminum Jacketing cut installation costs. It is also expected to cut maintenance costs.



Childers Aluminum Jacketing is used here on a cross-country transfer line at a large chemical manufacturing plant in Texas. This is a rugged test for any jacketing, but the light-weight aluminum used in this jacketing should stand up to weather and chemical corrosion it encounters.

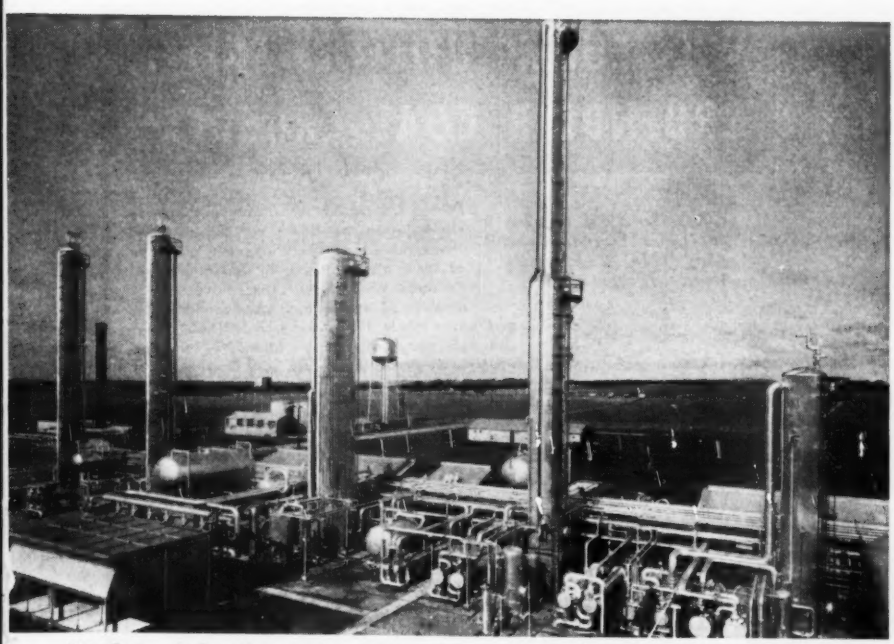


"Good Housekeeping" is the word in this gas pipeline pump station. The insulated lines are handsomely protected by Childers Aluminum Jacketing, which should last as long as the plant itself. The jacketing requires no painting and very little other maintenance. It even allows the interior of the plant to be washed with a hose without harm to the insulation. The chief engineer reports: "We have standardized on Childers Jacketing for all our insulated lines. It is doing an excellent job for us and saving us money."

How 5 plants cut costs of jacketing insulated lines

Weather-resistant, low-cost, easy to put on—these are big reasons for the growing popularity of a new jacketing, specially engineered for insulated lines. It is made of .006" thick aluminum and comes with or without a moisture barrier. It is called Childers Aluminum Weatherproof Jacketing. You can write for a free sample without obligation.

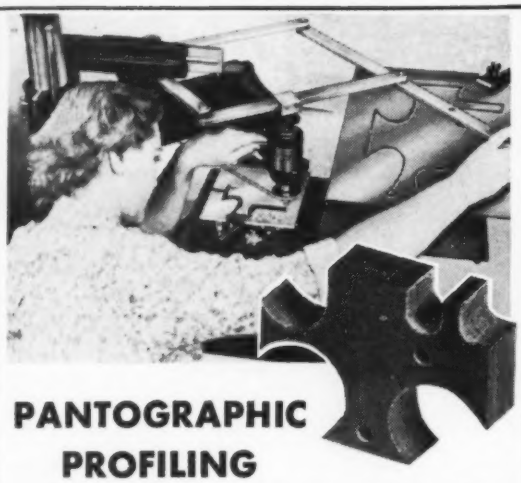
Address Childers Manufacturing Co., Dept. PO-5, 3620 W. 11th St., Houston 8, Texas.



Weather, wind and corrosive gases are not going to attack the insulation of this new plains-country gasoline plant. The insulation is protected by long-lasting aluminum: Childers Aluminum Weatherproof Jacketing. The management expects this low-cost jacketing to hold insulation maintenance costs to a minimum. Other advantages are that the jacketing went on quick and easy during construction; it required no special tools or skill — no shop forming or cutting. It can be taken off and re-used if lines are moved. Aluminum saves on painting and the tough 3S alloy used for Childers Jacketing should stand up for years even in highly corrosive industrial atmospheres. Check the advantages of this jacketing for your own plant.

Amazingly easy to handle, Childers Jacketing was applied here by men using no more than a wooden wedge and a pair of pliers. Childers has engineering representatives in every major industrial center who will be glad to confer with you on your particular jacketing problems. Write to address shown above.

Advertisement



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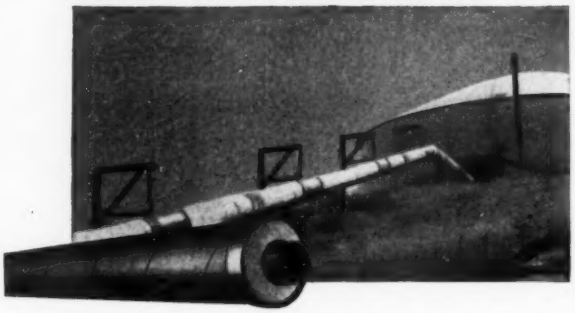
RIC-WIL KEEPS THIS WATER LINE FROM FREEZING!



Project: Water Works Improvement; Ishpeming, Michigan.
Consulting Engineer: Drury, McNamee & Porter; Ann Arbor, Michigan.
Contractor: L. W. Brumm; Marquette, Michigan.

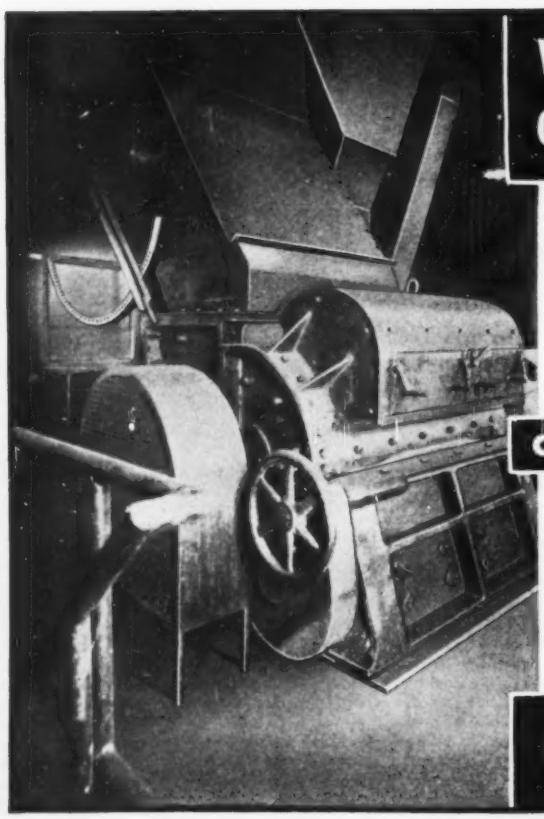
This overhead Ric-wiL pipe line, connecting an elevated storage tank to the distribution system, is protected from freezing even during winter temperatures as low as –40° F.!

For normal flow, ample thermal efficiency is assured by using 3" thick Fiberglas insulation, with a ¾" dia. steam tracer provided for stand-by use if required.

The 12" steel water line is coated on the inside with Ricwilite phenolic resin for corrosion resistance, and the entire prefabricated system is housed inside 21" dia. RIC-WIL HEL-COR Conduit for protection against the elements.

Ric-wiL PREFABRICATED INSULATED PIPING — UNDERGROUND OR OVERHEAD

THE RIC-WIL COMPANY · CLEVELAND, O.



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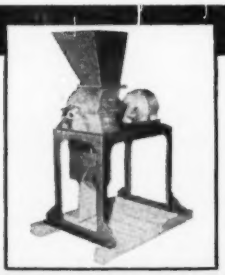
Gruendler Coal Crusher at Union Electric Company's No. 2 Plant in Venice, Illinois.

Public Utilities must leave nothing to chance when shut-downs can directly effect thousands of people. That's why so many of them are switching to Gruendler Coal Crushers. Gruendler Crushers have a long-established reputation for dependability, service and economy, in the making since 1885. Write for the complete story without obligation. You will see why **Public Utilities prefer Gruendler Coal Crushers.**

COAL SAMPLE CRUSHER

Write for literature describing the Gruendler Laboratory Coal Sampler. Sampler and Gruendler Riffle Bucket, approved by U. S. Bureau of Mines, enables you to obtain accurate coal samples and determine BTU measurements quickly and economically.



GRUENDLER CRUSHER & PULVERIZER CO.
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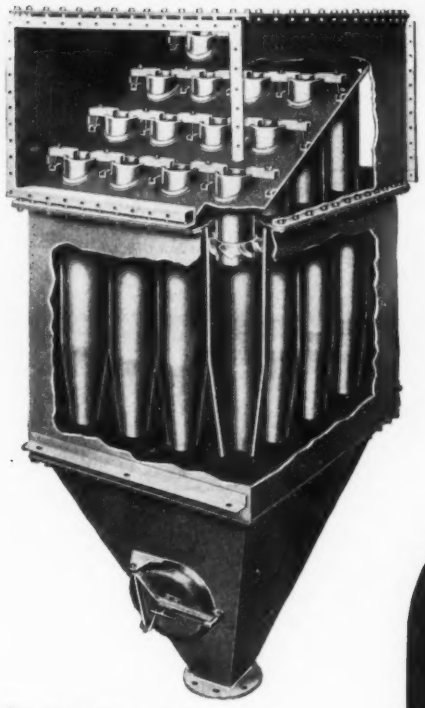


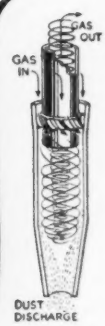
No wonder "MULTICLONE" *is the leading name in the centrifugal recovery of dust and fly ash from all types of gases, hot or cold.*

No other mechanical recovery equipment has so many years of dust and fly ash recovery experience behind it . . . or has such uniformly high collecting efficiency . . . or provides so many other money-saving, space-saving advantages as MULTICLONE. The four advantages outlined below are by no means the complete MULTICLONE story, but are typical of the vital savings found *exclusively* in MULTICLONE equipment . . .

in dust and fly ash recovery

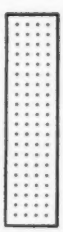
MULTICLONE COLLECTORS

***and only Multiclones* give vital advantages like these . . .**

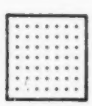


Uniformly High Recovery:

MULTICLONE's multiple *small diameter* tubes—made possible by its exclusive vane design—whirl the dirty gases with greater centrifugal force, thus throwing out not only the large, medium and small particles, but also a high percentage of the *extremely small* particles of 10 microns and less. This, coupled with the fact that there are no pads or filters to become choked with recovered material, results in a more complete recovery of *all* suspended materials from the gas stream.



Long and narrow



Square

Maximum Adaptability:

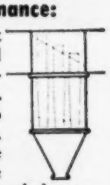
In addition to its unusual compactness, the MULTICLONE is also unusually adaptable to various installation requirements. Where head room is low it can be installed with side-inlet side-outlet connections. Where side clearances are restricted, it can be installed with side-inlet top-outlet connections. In addition, without changing capacities, the shape of the unit can be varied—long and narrow, short and wide, or square—to fit restricted spaces . . . and its single-inlet single-outlet duct requirements permit greater flexibility and simpler installation. These savings slice installation costs, space requirements and insulating expense.

Space-Saving Compactness:

Plant space costs money—so be sure to check space requirements carefully. As shown in the accompanying chart, the MULTICLONE requires less floor space and less cubic space than any other unit of comparable capacity and performance. Translate these savings into today's high costs for plant space and you readily see the great importance of this one MULTICLONE advantage alone!

Make	Relative Space Requirements In Sq. Ft.	In Cu. Ft.
Multiclone	1.0	1.0
Collector A	2.1	1.8
Collector B	5.9	3.2
Collector C	6.8	3.9

Minimum Maintenance:



The MULTICLONE has no high speed moving parts to repair or replace . . . no pads or filters to clean or renew . . . nothing to choke the gas flow or increase draft losses as suspended materials are recovered. MULTICLONE draft losses remain uniformly low *at all times*. Further, the recovered material from an entire bank of tubes is collected in a *single* hopper—far easier to service and maintain than the multiple hoppers of conventional cyclone units.

FREE INFORMATIVE BOOKLET
This 32 page booklet outlines the basic principles of centrifugal dust recovery and shows the *many* ways MULTICLONE advantages assure higher recovery at lower overall costs. A free copy of this booklet will gladly be sent on request. Write today!

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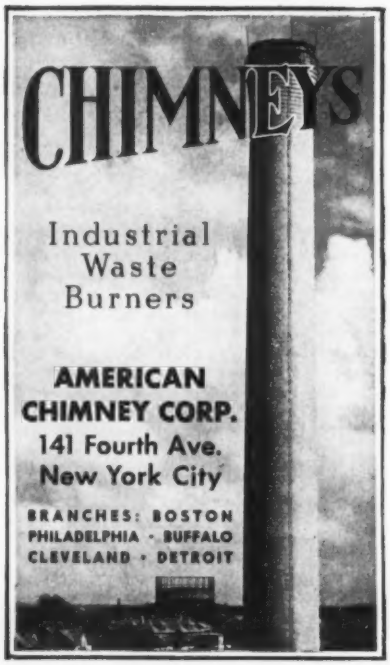
Featuring additional products, specialties & services for power plants



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A Good Habit

This Where To Buy Section supplements other advertising in this issue with additional announcements of products and materials of special interest and application in the power generation and transmission field. Make a habit of checking this page each issue.

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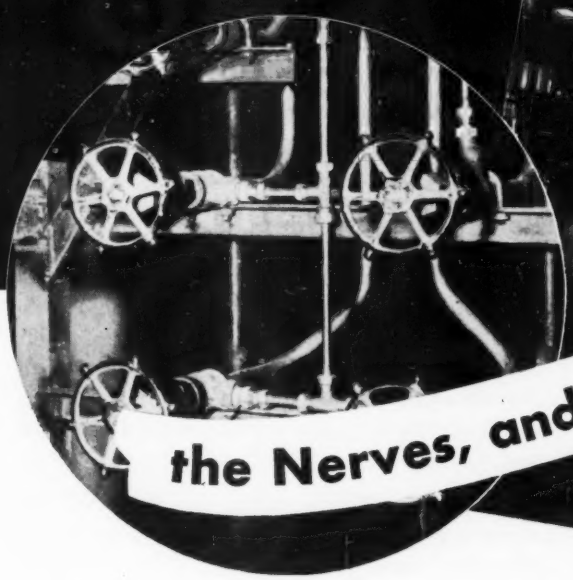

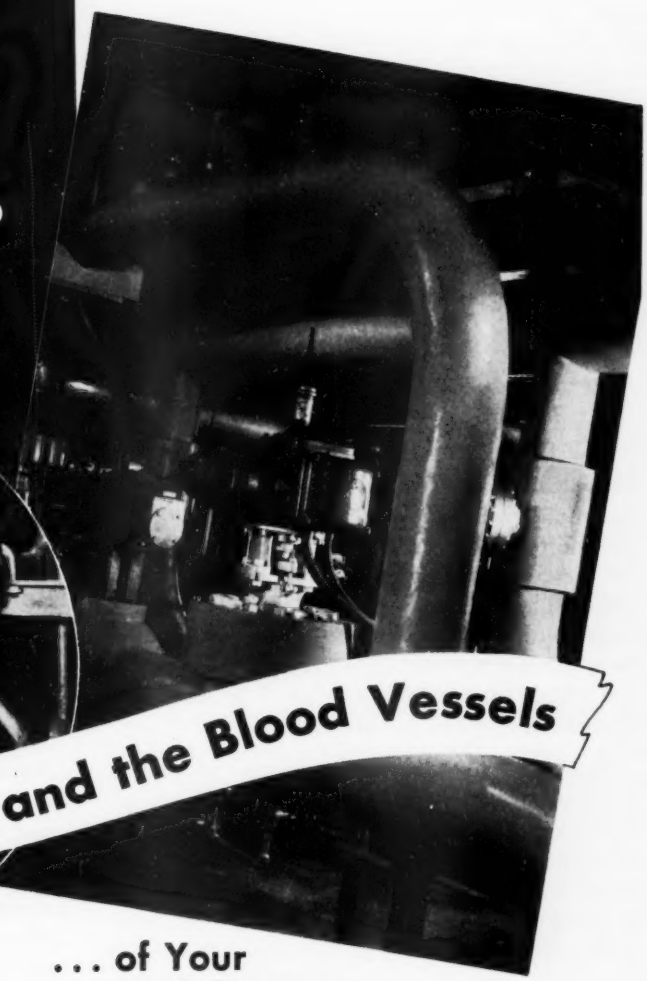

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And — the material from which the piping is made — and the way it is put together — will determine the efficiency and longevity of the system.

It's possible for a strong man to be a "physical wreck" because of a deficiency in his nervous system — and it's just as possible for a power plant to perform erratically because of inefficient engineering and installation of accessory piping.

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One Sure Way to Get MORE DEFENSE FOR LESS MONEY

How can we get more national defense for less money? The best answer yet given to this question appears in a little-noticed section of the new defense budget. That answer, with which this editorial is concerned, is to provide more equipment with which to step up munitions production in an emergency. Thus we can eliminate much of the need to stockpile finished munitions in advance.

The new defense budget provides an appropriation of $500 million, to be invested by the Secretary of Defense in specialized facilities required to produce munitions on a wartime scale, but not adapted to profitable operation by private industry in normal times. Facilities of this type are known as "stand-by capacity."

There is no strictly political controversy over the "stand-by capacity" program. It was originally suggested by Clay Bedford, Special Assistant to the Secretary of Defense during the Truman administration. It has since been reviewed and endorsed by the Eisenhower administration. Moreover, it involves little or no technical controversy. Civilian and military experts are well agreed that the only alternative to enormous expenditures for stockpiling military equipment is to provide enough facilities for producing it quickly in an emergency.

Here is the Key Idea

In his speech of May 19, introducing his defense budget to Congress and the nation, President Eisenhower stressed the value of such reserve capacity in these terms, ***"The more swiftly and smoothly we can mobilize, the less our dependence upon costly standing armies and navies."***

In accord with this idea, the $500 million requested for the present reserve capacity program would be invested in tools that require a long time to produce, and so present grave complications in an emergency unless they are ready in advance. Some such tools would be installed in new plants that are needed to eliminate potential bottlenecks in the defense production program. Others would be ordered to replace that part of the government's present machine-tool inventory which is made obsolete by changes in the design of defense products. By completely "tooling up" with the most modern equipment, the admin-

istration hopes to realize a production potential many times greater than could be achieved by spending the same amount of money on military end-products.

Examples of Savings

In the specialized field of defense production, adequate modern capacity is the key to both economy and speedy delivery in a pinch. Here are some striking examples from the recent report of the Advisory Committee on Production Equipment (Vance Committee) to the Director of Defense Mobilization:*

—In the case of certain ammunition components, the cost of new capacity can be recovered in only six weeks of full production.

—If $500 million worth of special tools needed to make aircraft are purchased in advance, aircraft production during the first two years of war will be increased about $18 billion. In other words, it costs 1/36 as much to acquire the tools in advance as to acquire the aircraft.

—In the case of a certain ordnance item, an expenditure equal to the cost of only 150 units of the item will provide the capacity to produce thousands and save three years' time in meeting mobilization requirements.

Moreover, reserve plants and equipment can be kept up-to-date at only a small fraction of the cost required to maintain an up-to-date reserve of military end-products. The cost of replacing 5,000 obsolete tanks is at least $1 billion. The cost of new tools for a tank plant would be less than 10% of that amount.

*This Committee, headed by Mr. Harold Vance, President of the Studebaker Corporation, included Clay Bedford, then President of Chase Aircraft, Manly Fleischman, former Defense Production Administrator, and several retired military leaders with wide experience in procurement.

Savings Will Multiply

On the basis of facts like these, the Vance Committee recommended that the Defense Department spend $500 million to $800 million per year on specialized defense production facilities in order to provide substantial reserve capacity as soon as possible. It also recommended that expenditures for military end-products which get obsolete rapidly be held to a minimum. The Eisenhower administration has adopted this approach to the problem of munitions production in asking that $500 million be invested in reserve capacity.

The importance of this approach is much greater than is indicated by the amount of money to be spent on new tools, although this amount will go far toward assuring a healthy machine tool industry, adequate to meet emergency demands. ***What is really important is the great saving that can eventually be made in the cost of our defense program by a modern tooling program.*** If we are to maintain this program for a long period, and if we are to pay as we go, we must have a low-cost program. No other plan to reduce and control the cost of a garrison economy can compare with the new approach suggested in the Vance Report and now embodied in the new defense budget.

Congressmen will do well to scrutinize all military appropriations carefully. They have a chronic tendency to be too big. But there should be no penny-pinching on investments in capital equipment that will pay out in as short a time as six weeks in a war emergency. It would be tragic if this opportunity for real economy were lost in the controversy over other aspects of the defense program. ***The tooling program is a key part of the Eisenhower effort to cut defense costs. It should be promptly approved.***

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An advertising inch is measured ⅞" vertically on one column, 3 columns—30 inches—to a page.

New Ads: Send to 330 W. 42nd St., New York 36, N. Y. for September issue closing August 13th.

STOKER ENGINEER

Old, well established and progressive firm located on Eastern Seaboard seeks engineer thoroughly schooled in design and operation of both "underfeed" and "spreader" stokers for industrial and utility boilers.

Applicant must be adept in coordinating, engineering, production and operation, and must have at least ten years' experience in this field. Applications will be held in strictest confidence.

P8320, POWER
330 W. 42 St., New York 36, N. Y.

ASSOCIATE DIRECTOR OF RESEARCH

National Manufacturer of air handling, air cleaning, and air conditioning equipment seeks graduate mechanical engineer as Associate Director of Research. Ten to fifteen years professional experience in similar research, engineering college or allied industry desired.
Salary commensurate with experience. Reply giving personal and professional background.
P-8307, POWER
330 W. 42 St., New York 36, N. Y.

ESTIMATORS

Young engineers capable of mechanical estimating for construction of refineries, steam power and similar industrial projects. Must have some field experience. Considerable weight given to ambition, intelligence and interest in estimating and cost analysis.

BECHTEL CORPORATION
220 Bush Street
San Francisco, California

REPLIES (Box No.):
Address to office nearest you
NEW YORK: 330 W. 42 St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS WANTED

CHIEF POWER Plant Engineer, 46, 20 years experience as assistant chief engineer, Chief Engineer, and manager of hydro and steam electric systems. Seeks permanent position supervising modern electric utility or industrial plant. PW-8366, Power.

MECHANICAL ENGINEER, 32. Registered Alabama, Louisana. 10 yrs. experience industrial plant Design, Construction & Operation. Present salary $10,000. Desire change and real opportunity. Will relocate. PW-8367, Power.

ENGINEER: CHIEF—Plant—Maintenance graduate—several years heavy experience. Steam and electrical generation and distribution—refrigerating and air-conditioning etc. General plant Master Mechanic. Utility or Industrial. Domestic or Foreign. "Engineer" 331 W. Marguette Road, Chicago 21, Illinois.

ERECTING ENGINEER, 45, 20 years exp. installing, operating, servicing, power plant and industrial equipment. Responsible, for permanent position modern power plant as master mechanic or asst. chief engineer. PW-8506, Power.

MECHANICAL ENGINEER, with twenty-five years experience in the design, erecting, maintenance, & operation of heavy industrial equipment desires position as Plant Engineer. PW-8517, Power.

POSITION WANTED: Chief Operating Engineer. Energetic, reliable, married man, age 44, excellent health, now employed as Assistant Chief Engineer with 16 years experience in all phases operation and maintenance of medium sized stoker oil, and gas fired steam plants, desires permanent position Chief Operating Engineer in industrial plant. PW-8442, Power.

ADDITIONAL POSITION VACANT ADVERTISEMENTS on the opposite page

WANTED

MECHANICAL ENGINEERS

Established consulting firm, New York area, desires Mechanical Engineers, capable supervising starting, testing, operating and correcting troubles of steam electric station equipment. Plant betterment work involving considerable travel. Technical education and plant operating or betterment experience required. State education, experience and salary desired.

P-8516, POWER
330 W. 42 St., New York 36, N. Y.

WANTED

OPERATING ENGINEER

For Municipal Power Plant. Should have several years experience in the operation of turbo generators, boilers, combustion controls and other equipment in connection with power plant operation. After expansion program is complete plant will have a capacity of 33,000 KW. Excellent opportunity for advancement. Plant is located in a southern city of 25,000 population.

P-8474, POWER
520 N. Michigan Ave., Chicago 11, Ill.

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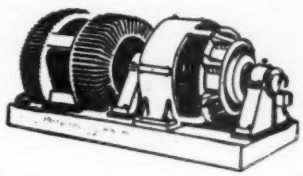
PIERCE CABLE CO.
2668 CLYBOURN AVE., CHICAGO 14, ILLINOIS

POWER PLANT CHEMICAL ENGINEER

Graduate Chemical Engineer with Power Plant experience in design, operation and trouble shooting of all water treatment processes, including deionization, for high pressure boiler operation, experience in industrial waste treatment desirable. Headquarters Kansas City, Missouri; submit education and experience.

BLACK & VEATCH, *Consulting Engineers*
4706 BROADWAY KANSAS CITY 12, MISSOURI

SEARCHLIGHT EQUIPMENT SPOTTING SERVICE



This service is aimed at helping you, the reader of POWER, locate used and surplus new power equipment not currently advertised (this service is for user-buyers only).

Just send in the specifications of the equipment wanted on the coupon below, or on your own company letterhead, to

Searchlight Equipment Spotting Service
c/o POWER
330 W. 42nd St., N.Y. 36, N.Y.

Your requirements will be brought promptly to the attention of the used equipment dealers advertising in this issue. You will receive replies directly from them.

NO CHARGE • NO OBLIGATION

Searchlight Equipment Spotting Service
c/o POWER
330 W. 42nd St., New York 36, N. Y.

Please help us locate the following used equipment:

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NAME ..... TITLE .....

COMPANY .....

STREET .....

CITY ..... ZONE ..... STATE .....

8/53

THE TRADE MARK WITH A MEANING
SUCCESSFUL OPERATION GUARANTEED
*45th Year of Service—Member of A.R.A.**

A. C. MOTORS
3 ph. 60 Cycle

SYNCHRONOUS

Qu.	HP	Make	Type	Volts	Speed
1	4350	Cr. Wh.		4160/13800	514
2	3500	G. E.	TS	2300	257
1	2500	G. E.	ATI	2300	720
2	2100	G. E.	ATI	2300	360
2	2000	Whse.		2300	120
1	2000	G. E.	ATI	2200	900
2	1750	G. E.	ATI	2300	3600
3	735	G. E.	ATI	2200/12000	600
1	500	Ideal	SM	2300/4150	1800
1	450	Whse.	Eng.	2200	128.5
1	450	Whse.		2300	450
2	350	G. E.	TS	2200	150
1	300	Whse.		2300	720
1	150	Whse.		440	600

SLIP RING

1	1500	G. E.	MT-498	2300	360
1	1500	ABB		2300	720
1	1200	G. E.	MF-26	2300	275
2	1000	A. C.	Mill	2300	240
1	500	Whse.	CW	550	360
1	500	G. E.	IM	2300	900
1	400	Whse.	CW-1218	2200	435
1	400	Whse.	CW	440	514
1	350	G. E.	MT-442Y	2300/4000	253
2	300	G. E.	MT-565Y	2300	900
1	250	G. E.	IM-1713	2300	450
1	250	G. E.	MT-424Y	4000	250
1	250	G. E.	MT-559S	2200	1750
1	240	A. C.		550	600
1	200	Cr. Wh.	26QB	440	505
1	200	G. E.	IM	440	435
1	200	G. E.	MTP	440	1170
1	200	Whse.	CW	440	490
1	150new	Whse.	CW	2300	450
1	150	G. E.	IM-16	440	600
2	125	A. C.		440	865
1	125	A. C.		440	720
4	125	G. E.	MT-566Y	440/2200	435
2	100	G. E.	IM	440	600
1	100	G. E.	IM	2200	435
4	100	A. C.		440	695
4	100	G. E.	MT	440/2200	435

SQUIRREL CAGE

2	650	G. E.	FT559BY	440	3750
2	450	Whse.	CS	2300/4150	354
1	200	G. E.	IK-17	440	580
2	200	G. E.	KT-557	440	1800
1	200	G. E.	IK	440	865
1	75/150	G. E.	IK	440	450/900
1	150	Whse.	CS	440	580
1	150	Westghse.	CS8568	440	830
1	125	Whse.	MS	440	485
2	125	At. Ch.	ARW	2200	1750
2	100	G. E.	IK	440	580
1	100	G. E.	IK-Vert.	2200	450

D.C. MOTORS

Qu.	H.P.	Make	Type	Volts	Speed
1	2200	G. E.	MCF	600	360/500
1	2000	Whse.	Mill	600	230/460
1	940	Whse.	QM R Brg.	250	140/170
1	900	Whse.		250	450/550
1	825	Whse.	Mill	250	90/180
1	600	A. Ch.	MILL	230	400/800
1	500	Whse.	Mill	600	300/900
2	450	Whse.		550	415
1	400	G. E.	MCF	550	300/1050
1	300/400	G. E.	DYNA	250	1325/2500
2	300	Whse.	CB-5094	230	575/1150
1	200/300	G. E.	MPC	230	360/920
1	250	G. E.	MPC	230	400/500
1	200	Rai.	1970T	230	720
1	200	Whse.	CB-5113	230	400/800
1	150	G. E.		600	250/750
8	150	Cr. Wh.	83H	230	890
1	150	Cr. Wh.	CMC-65H	230	1150
1	150	Whse.	SK-201	230	360/950
1	150	Whse.	SK-141 B	230	900/1800
1	125	G. E.	MDS-416	230	415
1	50/120	G. E.	MFC	230	250/1000
2	100	Whse.	SK-181	230	450/1000
1	60	El. Dy.	25-8	230	525/1050
2	50/60	Whse.	SK-170	230	400/1200
1	50	G. E.	CO-1810	230	725
1	50	Whse.	SK-170	230	350/1050
9	50	G. E.	RCF-31B	230	1700

MOTOR GENERATOR SET
3 ph. 60 Cycle

Qu.	KW	Make	Speed	D.C. Volts	A.C. Volts
1	2000	G. E.	514	600	13800/4000
2	2000•	G. E.	500	600	6600/11000
2	1500	G. E.	514	250	4000/13200
1	1500	G. E.	720	600	6600/13200
1	1500	G. E.	360	275	2300/4400
1	1500	G. E.	600	600	2300/4150
1	1500	C. W.	514	115	4160/13800
1	1200	A. C.	720	550	2300
2	1000	Whse.	900	600	2300/4100
1	1000	G. E.	900	260	6600
1	1000(3U)	G. E.	900	250	2400/4800
2	750	Whse.	900	275	2300/4160
1	750	C. W.	514	115	2300
1	600	G. E.	720	250	440/2300
1	500	Whse.	900	125/250	440
1	500	Whse.	1200	125/250	2300
1	500	G. E.	720	125	2300/4000
1	400	G. E.	720	250	440/2300
1	150	G. E.	1200	250	2300
1	150	Whse.	1200	275	2300
1	150	G. E.	1175	125	440
1	140(3U)	Cr. Wh.	690	125/250	2300
1	125	G. E.	1200	125	440
1	100	Delco	1200	125/250	440
1	100	G. E.	1200	250	2300/4000
2	35	Whse.	1750	125/250	2200

FREQUENCY CHANGERS

Qu.	KW	Make	Cycles	Voltage
1	12500	Whse.	60/25	13200x13200
1	3000	G. E.	25/60	4000/2300x2300/4000
1	2500	G. E.	25/60	2400x4150
1	2000	G. E.	25/62½	2300/4150
1	2000	Whse.	25/62½	2300/2300
1	1000	G. E.	25/58	4400/2300
1	600	A. C.	25/60	11000/2300V

TURBO GENERATORS

Qu.	KW	Make	Desc.
1	1000	Moore	Auto-Ext. Cond. 175/200# I.S.P 5/30# G. Ext. Surface Condenser—3/60/2300.
	1000	G. E.	Non-condensing 175/200 lbs. I.S.P. 5/20 lbs. G.B.P., 480/3/60.
	750	G. E.	Condensing 425#-725#T I.S.P. 440 V. 3 ph. 60 cy. New—1944
	750	Whse.	Non-condensing 135# I.S.P. 40# B.P. 750 Kw. 280 V. D.C.
	500	Moore	Non-condensing — 150/200 lbs. ISP 5/35 lbs. G.B.P.—3/60/480 volts direct connected exciter.
	500	G. E.	Non-condensing 175/200 lbs. I.S.P., 5/30 G.B.P., 480/3/60.
	400	Whse.	Non-condensing 125/150# I.S.P. 5/10# G.B.P., 240/480v. 3 ph. 60 cy.
	300	G.E.	Non-condensing 10/175# I.S.P. 5/15# B.P. 480V. 3 ph. 60 cy.
	200	Whse.	Non. condensing 150# I.S.P. 7# B.P. 240 V. 3 ph. 60 cy.

TRANSFORMERS
60 Cycles

Qu.	KVA	Make	Type	Ph	Voltages
1	5000	Whse.	OISC	3	33000x26400/13200
1	3500	G. E.	WCT	3	13800/6900x2300/440
1	2500	Whse.	OISC	3	26400/13200x460
3	2000	G. E.	HVDDJ	1	66000x13800
2	1750	G. E.	WCT	3	13800/6900x2300/440
3	1000	G. E.	H	1	2200x480
1	1500	G. E.	HT	3	13200x2300
3	1250	G. E.	H	1	6600x550
1	1150	A. C.	OISC	3	13200x2300/480
2	1000	Pitts.	OISC	3	2300x460
4	1000	Al. Ch.	OISC	1	2300/4000x460
3	1000	Wagner	OISC	1	13200x220/440
2	300	Kuhl	OISC	3	13800x460
3	200	Whse.	O15C	1	13200x120/240
1	150	G. E.	HT	3	25000x120/208
3	150	Whse.	OISC	1	33000x2300/4000
2	75	Upte	OISC	3	4160x240

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LAND'S 44th YEAR
MOTORS & GENERATORS, etc.
1 YEAR GUARANTEE

GENERATORS—250 V. D. C. Motor Drives

KW	Make	Type	Speed
2000	G. E.	New	900
1150	G. E.	New	900
1000	Al. Ch.		720
250	Cr. Wh.	CCD	1200
150	West.	SK	900
125	G. E. (3)	MPC	1200
125	El. Dy.	20L	1750
100	Delco (4)		1150
75	West.	SK	900
75	Cr. Wh.	51H	1150
50	Cr. Wh.	HH	1150
40	West.	SK	1750
35	Al. Ch. (4)	3 wire	1750
25	G. E.	CS	1200
17	G. E.	RC	1750
15	Star		1750
7½	West.	SK-43	1750
5	West.	SK-284	1750
5	Rei.	T-23T	1750
3	Rei.	T-14T	1740

GENERATORS—Low Voltage D.C.

Amp.	Make	Voltag
10,000/5000	H-V-W	6/1e
3000/1500	Chandey.	12/22
2500/1250	Chandey.	6/14
2000/1000	H-V-W	6/12
750	H-V-W	6/12
4000/2000	North.	7½/12
3000/1500	Chandey.	8/15
10,000	J-L	16
1000	G. E.	10
6000/3000	El. Prod.	18/35
1000	G. E.	26
1000	West.	25
100	Diehl	34
200	West.	32
200	Burke	35
125	Diehl	45
500	G. E.	30
1500	Century	42
3200	G. E.	55
325	West.	50
1000	G. E.	70
		4

230 V. D.C. MOTORS

H.P.	Make	Type	Speed
350	G. E. (2)	MDP 422	375/750
250	G. E.	MDP 420	410/820
250/200	Rei.	2600T	400/800
150	West.	SK	1150
150	West.	SK	850
125	Rei.	T	600
125/50	E. D.	20-SL	1750/1315
100	West. (4)	SK	1150
100	West. (6)	SK	850
100	Rei.	651-T	850
100	G. E.	RC	600
100	Rei.	1060T	500
100	A-C		1150
100	FM	TRC-38	725
90/45	G. E. (2)	RF-17	950/475
75	G. E.	CD-155	1150
75	West. (6)	SK	1150
75	G. E.	RC	1000
75	Rei.	461-T	850
75	West. (2)	SK	850
75	West.	SK	475
75	Cr. Wh.	CMC-125H	375/950
60	West.	SK	850
60	West.	SK-160	680
60	West.	SK	250/1000
50	Cr. Wh.	CMC-FH	1750
50	West.	SK-160	565
50	G. E.	RF-17	250/1000
40	G. E. (3)	CD-105	850
40	Cr. Wh.	FH	1750
40	West. (5)	SK	775
35	E-D	258	350/1050
35	West.	SK	250/1050
35	West.	SK	1150

SLIPRING MOTORS

H.P.	Make	Type	Speed
600	Cr. Wh.	131-AQ	507
500	G. E.	IM	600
500	G. E. (2)	IM	450
250	G. E.	1M	600
200	G. E.	MT-557Y	1750
150	G. E.	IM	870
125	West.	CW	1750
125	G. E.	IM	580
100	G. E.	MT347	1150
100	G. E.	IM	690

SQUIRREL CAGE MOTORS

H.P.	Make	Type	Speed
250	GE(TENV)	K-6335	1780
200	Wagner	RP2-26Z	1800
200	West.		1750
200	A. Ch.	AR	868
200	G. E.	KF-6335	880
150	West.	CS	1178
150	G. E.	IK	580
125	A. Ch. (2)	53R	3500
125	A. Ch. (5)	AR	1890
125	Century		3500
125	A. Ch.		690
100	West.	CS5078	3540
100	West.	CS	870

Partial Listing Only!

Please Send Us Your Inquiries

L. J. LAND, INC.

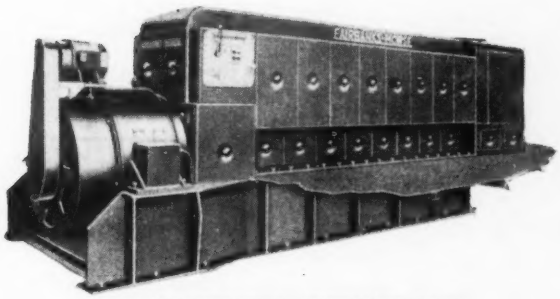
Established 1910

156 Grand Street, New York 13, N. Y.

CAnal 6-4976

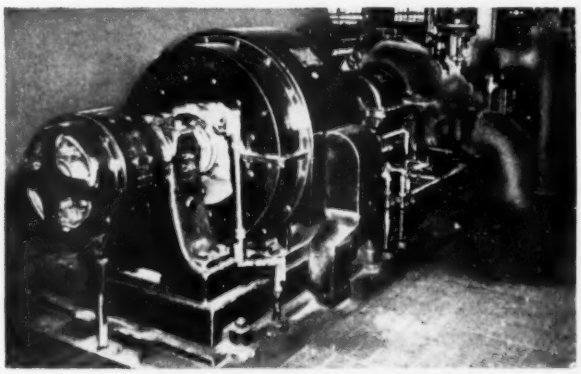
Special Bargain Offerings

DIESEL GENERATORS
UNAFLOW UNITS



DIESEL GENERATOR—INSTALLED 1949
413 KVA FAIRBANKS MORSE

TURBO GENERATORS



50 KVA TERRY 480 VOLT NON-CONDENSING
325 PSI, 110# GAUGE BACK PRESSURE

TURBINE GENERATOR UNITS

Condensing—3 phase, 60 cycle

30,000 KW G.E. 12,000 volts, 235# PSI
25,000 KVA 6600 volts, 235 PSI
6250 KVA G.E., 5-stage, 2300/4160 volts. 200# PSI, 600°TT.
6250 KVA Westghse., 480 volts, 400 PSI. 15# G. extract with condenser.
5000 KVA Westghse., 600 volts, 275 PSI. 25# G. extract with condenser.
4000 KVA Allis 2300 volts, 200 PSI.
3750 KVA Westghse. 2400/4150 volts, 350#
3750 KVA G.E. 2300/4000 volts, 200 PSI.
2500 KVA G.E., 2300/480 volts, 3600 RPM, generator **LESS TURBINE.**
1250 KVA Allis, 480 volts, 250 PSI, 25# G. automatic extraction.
1000 KVA G.E., 450 volts, 275-400 PSI, 750°TT geared unit.
940 KVA Westghse., 2300 volts, 180 PSI, mixed pressure automatic extraction.
940 KVA Elliott, 2300 volts, 3600 RPM generator **LESS TURBINE.**
500 KVA Terry, 480 volts, 325 PSI, 110# gauge back pressure, 650° TT (photograph above)

Non-condensing—3 phase, 60 cycle

5000 KVA G.E., 13,800 volts, 600 PSI.
1563 KVA G.E. 480 volts, 200 PSI, to 20# ga. back.
1250 KVA (2) G.E., 2300/480 volts, 150 PSI, 10# gauge back.
937 KVA ALLIS 480 VOLTS, 150#, 10# gauge back, excellent condition
625 KVA G.E., 2300 volts, 150 PSI, 40# gauge back.
125 KVA Westghse., 2400/480 volt, 125-250#, 5# ga. back. Geared unit.

UNAFLOW GENERATOR UNITS

3 phase, 60 cycle

750 KVA Skinner 240 volts, 150 PSI, 8# back.
625 KVA Skinner 2300/480 volts, 150 PSI, 10# back.
375 KVA (2) Skinner 2300/480 volts, 125 PSI, 8# back.
375 KVA Skinner 600 volts, 150 PSI, 10# back.
312 KVA Skinner, 240 volts, 125 PSI, 5# back.
250 KVA (2) Ames vertical 480 volts, 150 PSI, 5# back.
250 KVA (2) Skinner, 2300 volts, 150 PSI, 5# back.

SPECIALLY PRICED

- **9000 sq. ft. Condenser Engineering, 7000 sq. ft. and 5000 sq. ft. Wheeler surface condensers.**
- **12000 GPM, 25' hd. Worthington circulating pump direct connected to 200 HP, 3/60/2300 volt G. E. motor.**
- **6000 GPM Dayton-Dowd circulating pump, 70' hd. direct connected to 125 HP, 3/60/2200 volt G.E. motor.**
- **3500 GPM Allis dual drive circulating pump, 70' hd. direct connected to 75 HP, 3/60/440 volt Allis motor.**
- **5000 KVA Westghse. synchronous condenser 3 phase, 60 cycle, 4000 volts 720 RPM.**
- **150,000# per hr. B&W (2) cross drum water tube boiler 250# pres. 125°F superheat, Taylor Stoker.**
- **547 HP B&W Sterling water tube boiler 225# pres. built 1938.**

DIESEL GENERATOR UNITS

3 phase, 60 cycle

5000 KVA Busch Sulzer 6 units, complete plant, also available units of two.
1420 KVA Fairbanks-Morse 2400/4160 volts modern.
1250 KVA Nordberg, 2300 volts.
937 KVA General Motors 2400 volts.
900 KVA Worthington 2400 volts.
875 KVA DeLavergne 2400 volts.
413 KVA Fairbanks Morse, 2400 volts, 514 RPM complete installation installed 1949 (photograph above)
400 KVA (3) Alco, 440 volts.
375 KVA Fairbanks-Morse, 2300 volts, 300 RPM.
250 KVA (2) Buckeye, 220/440 volts.
185 KVA Fairbanks-Morse, 2300/480 volts, 300 RPM, Model 32-E-14, installed 1948. Guaranteed.
125 KVA Cooper Bessemer, 2400 volts.
20 KW Hill, 125 volt, **Direct Current.**

DIRECT CURRENT UNITS

540 KW Westghse. non-condensing turbine 250 volts D.C. NEW, 200# PSI.
400 KW G.E., 3-wire, 250 volts, 360 RPM generator connected Skinner vertical engine 150 PSI—5# back.
300 KW Westghse. 3-wire, 250 volts 150/250# PSI noncond. turbine.
100 KW G.E. 120 volts condensing or non-condensing geared 200-275 PSI.
60 KW (6) Elliott 125 volts condensing or non-condensing 200-250 PSI.

UMC UTILITIES MACHINERY CORP.
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✓ Complete Stock A.C. & D.C. Motors and Generators

✓ New and "Certified Rebuilt"— UP to 1000 H. P.

A. C. GENERATORS — 60 CYCLE

KVA	Mfr.	Type	Volts	Speed
1000	Whse. syn. cond.		4000/2300	900
625	Gen. Elec.	ATB	2300	450
625	G. E. 25 cycle	ATB	2300	750
600	Gen. Elec.	ATB	480	900
625	El. Machy.	Late	240/480	1200
485	Allis. Ch.	1 brg	480	400
350	El. Machy.	1 phase.	480	1200
312	Gen. Elec.	ATB	240/480	600
275	G. E. 25 cycle	ATI	480	750
225	El. Machy.		480	720
225	Gen Elec.	ATI	240/480	900
150	Gen. Elec.	ATB	2300	900
150	Whse.		2300/480	600
125	Gen. Elec. (2)	ATB	240/480	900
112	Gen. Elec.	ATB	240/480	900
90	Gen. Elec.	ATI	240/480	1200
75	Gen. Elec.	ATI	240/480	1200
75	El. Machy.		2300	900
56	G. E.	ATB	240/480	1200

SPECIAL PURCHASE!

2—DC 55 V. 3600 Amp. M-G Sets

Input—300 H.P. Whse. synch. motor, 3/60/220/440 V. 720 RPM, w/exciter.

Output—200 KW. generator, DC 55 V. 3636 amp. 720 RPM, w/exciter.

D. C. GENERATORS

KW	Mfr.	Type	Volts	Speed
300	Al. Ch.	MECW	125/250	1200
250	Allis. Ch. b.b	EW	350	1200
150	Whse.	SK191	125/250	900
125	Gen. Elec.	RC	250	1800
105	Century b.b.	1500 amp.	70	1200
100	Allis. Ch.	E	125	1200
100	Whse.	SK	250	1200
75	Cont. b.b.	D109X	125	1200
75	Gen. Elec. (2)	CD115	250	1500
75	Whse.	SK	250	1200
60	Whse.	SK160	250	1000
50	Whse.	SK	250	1100
50	Allis. Ch.	EW	125/250	1200
50	Gen. Elec.	RC	125	1200
40	Gen. Elec.	RC	600	1750
25	Whse.	SK93	125	1750
20	Gen. Elec.	RC	125	1150
15	Star b.b. (10)	SQ	250	1500

D.C. MOTORS

HP	Mfr.	Type	Volts	Speed
300	Gen. Elec.	MPC	250	500
300	Allis. Ch. b.b.	EW	350	1000
200	Al. Ch. b.b.	E	250	500/1000
150	Gen. Elec.	RC36	230	1700
100	G. E. dynamometer		250	1500 2500
100	Whse.	SK	230	850
75	Whse.	SK170	230	635
75	G. E. (2)	CD 115	230	1150
75	Whse.	SK163	230	850
60/75	Gen Elec.	C	230	500/1200
50	Whse.	SK150	230	750
50	Reliance b f	65IT	230	750
50	Gen. Elec.	CD123	230	550/1200
50	Gen. Elec.	RC33	115	1100
40	Gen. Elec. j2f	CD-93	115	1750
40	F. Morse b.b.	DH 120	115	1750
35	G. E.	RF-14	230	250/1000
30	Imperial b.b.	D69	230	400/1600
30	Gen. Elec.	LC	230	500/1500
30	Whse.	SK110L	230	1150
30	Star b.b. (3)	SB	230	1750
25	Whse.	SK150	230	3 0/1200
25	Gen. Elec.	CD85	230	1750
25	Gen. Elec.	CD105	230	/1725
20	Century bb.	DN336	230	3500
20	G. E. series	CO-1826	230	875
20	Whse. b.b. (2)	SK97	550	900

A. C. MOTORS

HP	Mfr.	Type	Volts	Speed
800	G. E.	Slipring	2300	400
750	Whse.	Synch.	2200/4000	900
700	G. E.	Synch.	2200	514
650	E. M.	Synch.	480	1200
500	G. E.	Sq. Cage	6600/4000	1800
500	G. E.	Synch.	440	900
500	G. E.	Slipring	2200/440	450
500	Al. Ch.	Synch.	440	400
450	Whse.	Synch.	2300	900
400	Whse.	Sq. Cage	2200	514
400	G. E.	Synch.	440	450
400	Allis. Ch.	Sq. Cage	2200	1200
350	G. E.	Slipring	2200/440	300
350	Whse.	Slipring	2300	450
300	Gen. Elec.	Slipring	2200/440	720
300	Al. Ch.	Sq. Cage	2200/440	720
300	El. Mach.	Synch.	2200	360
300	Whse.	Synch.	2200/440	600
300	Al. Ch.	Slipring	2300	514
300	G. E.	Slipring	440	360
250	G. E.	Slipring	2300	450
250	G. E.	Slipring	440	600
250	Whse. (2)	Sq. Cage	2200/440	1200
250	L. A. (2)	Sq. Cage	2200	1800
225	G. E.	Synch.	220/440	900
200	Allis Ch.	Slipring	440	450
200	Gen. Elec.	Sq. Cage	2200/440	720
200	G. E.	Sq. Cage	220/440	600
200	Cr. Wh.	Sq. Cage	220/440	3600
200	Whse.	Sq. Cage	2200/440	900
200	G. E.	Slip Rings	220/440	600
200	E. M.	Synch.	220/440	1200
200	G. E.	Sq. Cage	220/440	1200
200	G. E.	Slipring	220/440	360
200	G. E.	Sq. Cage	220/440	1800
200	Rel. b.b.	Sq. Cage	220/440	1200
200	E. M.	Synch.	220/440	514
160	Whse.	Synch.	220/440	600
150	G. E. TEFC	Sq. Cage	2200	3600
150	Allis. Ch.	Slipring	2200/440	720
150	G. E. (2)	Sq. Cage	2200/440	720
150	G. E.	Slipring	220/440	450
150	Allis. Ch.	Sq. Cage	2200/440	1200
150	Rel. b.b.	Sq. Cage	220/440	1800
150	Allis Ch.	Sq. Cage	440	450
125	Rel. TEFC	Sq. Cage	220/440	1800
125	G. E (2)	Slipring	220/440	600
125	G. E.	Slipring	220/440	450
125	E. M. (2)	Synch.	220/440	1800
125	Allis. Ch.	Sq. Cage	2200	900
125	G. E.	Slipring	2200/440	720

M-G SETS

KW	Mfr.	Input V	Output V
500	Whse.*	2300 AC	250 DC
300	Whse.*	2300 AC	250 DC
300	Allis. Ch.	2200/440 AC	125/250 DC
300	Whse.*	2300 AC	600 DC
250	Allis. Ch.	2200/440 AC	350 DC
250	Cr. Wh.*	2200/4000 AC	250 DC
200	Whse.*	2200/4000 AC	250 DC
200	Whse.* (2)	220/440 AC	55 DC
200	G. E.*	220/440 AC	250 DC
200	Gen. Elec.*	220/440 AC	125 DC
150	Whse.*	220/440 AC	125/250 DC
125	Gen. Elec.	220/440 AC	240 DC
105	Century b.b.	220/440 AC	70 DC
100	Whse.*	2300/4000 AC	275 DC
100	Al. Ch.	220/440 AC	125 DC
100	Delco b.b.	220/440 AC	125/250 DC
90	G. E.* (2)	220/440 AC	125 DC
75	Cont. b.b.	220/440 AC	125 DC
75	Whse.	220/440 AC	250 DC
60	Gen. Elec.*	220/440 AC	60 DC
50	Whse.	220/440 AC	250 DC
50	Gen. Elec.	220/440 AC	125 DC
50	Allis. Ch.	220/440 AC	125/250 DC
45	Gen. Elec.*	220/440 AC	60 DC
40	Gen. Elec.	220/440 AC	600 DC
30	Otis (5)	220/440 AC	250 DC
25	Whse.	220/440 AC	125 DC
25	Gen. Elec.	220/440 AC	250 DC
17	Gen. Elec.	220/440 AC	125 DC

*Synch. motor.

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STEEL MILL DRIVE ELECTRICAL EQUIPMENT

We own and offer, in original crates, the following G.E. NEW steel mill equipment:

2—350 HP, 375-750 RPM, 230 V., MDP-422 Mill Motors w/blower and fan.

1—250 HP, 410/820 RPM, 230 v., MDP-420 motor W/blower and fan

3-unit synchronous motor generator set—suitable for 60 cycle

1—1250 KW, 750 RPM, 600 v., shunt wound DC gen. 40°C rise

1—750 KW, 750 RPM, 250 v., shunt wound DC gen. 40°C rise

1—3000 HP, 750 RPM, 6000 v., 3 ph., 50 cy., .8 PF, 40°C rise

3-unit synchronous motor generator set—suitable for 60 cycle

1—400 KW, 750 RPM, 250 v., shunt wound DC gen. 40°C rise

1—750 KW, 750 RPM, 250 v., shunt wound DC gen. 40°C rise

1—1750 HP, 750 RPM, 6000 v., 3 ph., 50 cy., .8 PF, 40°C rise

Control equipment for the above is available. Your inspection is invited.

Inventory is too large to list.

Send us your inquiries.

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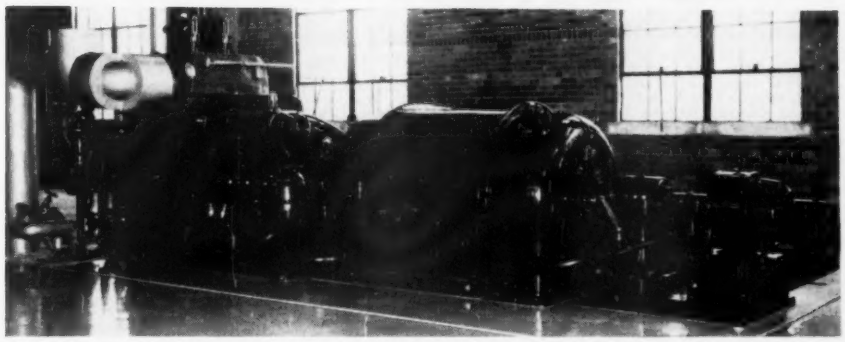
1000 KW.

WESTINGHOUSE CONDENSING TURBINE-GENERATOR

MODERN • VERY GOOD CONDITION • A COMPLETE UNIT 400 lbs.



Above Westinghouse is a 1000-KW @ 80%—P.F., 1250-KVA., 400# psig., 3/60/2300-v. Is Complete with all piping and accessories, Surface Condenser, Switchboard, Shaft Exciter, Etc. Turbine Serial #12580: Generator #4791874. IMMEDIATE DELIVERY.

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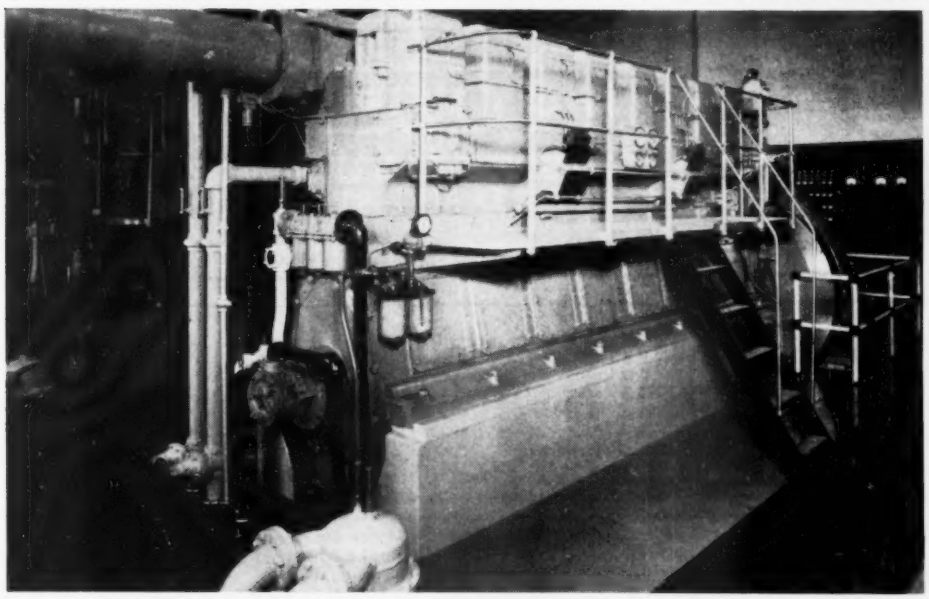
3350 HP

COMPLETE COOPER-BESSEMER POWER PLANT: 5-670 HP., Engines 400-RPM., 2300-volt. Each Equipped with 475-KW. IDEAL GENERATORS.



Above 5-670-HP., Engines (our own property) Still on Foundations. Will be run for Inspection. Will sell as Complete Unit, or Engines separately. Each engine equipped with switchboard and all appliances for separate operation. Is the most complete and finest plants we have ever owned. Is priced at a fraction of its original cost. Large lot of spare parts. INVESTIGATE NOW. ENGINES ARE LIKE NEW MACHINES.

ALSO OWN AND OFFER 2—Fairbanks-Morse, 1600-HP., O.P., Diesel Engines, 720-RPM., or 1800-HP., at 800-RPM. Same as New. Immed. Delvy.

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MOTOR GENERATOR SETS

1500 KW G.E. 250 Volt 3/60/2300/360 RPM
1—1000 KW West. 250 volt Flat Compound 500 RPM 1440 H.P. West. Syn. Mtr. .8 P.F. 3/25 cycle 2300 V. A.C. & D.C. Panels
1—500 KW Crocker Wheeler CCD, 250 volt 720 RPM with 750 KVA Cr. Wh. Syn. Motor 3/60/2300 V. A.C. & D.C. Panels.
1—300 KW West. 3 wire 125/250 Volt 1200 RPM Generator (1938 year). Can furnish with suitable motor. Advise Requirement.
200 KW Elliott 250 Volt 1200 RPM 3/60/ Any Voltage.
2—150 KW G.E. Type MPC—250 Volt 1200 RPM 3/60/2300/200 H.P. Syn. Motor Drive A.C. & D.C. Panels
100 KW Electro Dynamic 200 V. 3/60/220/1200 B. Brg. Sq. Cg. Sep. Excited.
1—100 KW Al. Ch. 250 V. 1200 RPM 150 H.P. Syn. Mtr. 2/60 or 3/60 any voltage.
1—100 KW G.E.—C.D.—125 Volt D.C. 150 HP GE Syn. Mtr., 3/60/220/440/1200 RPM.
1—75 KW Burke 250 V. 900 RPM 113 H.P. Burke—Syn. M.D. 2 or 3 ph, any voltage.
2—50 KW GE 500 Volt DC, 75 HP, 3/60/40/ 1200 RPM.
Smaller Sizes and Types—Advise Requirements

1—New O'Brien "Red-Line" 750 KVA OISC Transformer 13,200/13,800 v. pri., 480 v., sec., 3 ph.
3—333 KVA New O'Brien Red Line O.I.S.C. Transformers 4160 V primary 480 V secondary ea. single ph. 60 cyc.

BOILERS

4—500 HP Cleaver Brooks Package 200 lb.
1—300 HP Cleaver Brooks Package 160 lb.
1—450 HP Keeler CP 160 lb. Oil
1—300 HP Keeler CP 300 lb. Oil
1—150 HP Union Univ. Stoker 150 lb.
1— 60 HP Ames Package 125 lb.

DIESEL GENERATOR SETS

1—1250 KVA Nordberg 3/60/2300/360 RPM 1940
1—375 KVA GM 8-268A, 3/60/480/1200 RPM
1—250 KVA G.M. Twin 6-71, 3/60/220/440/ 1200 RPM Rad. Cooled.
1—187 KVA G.M. Twin 6-71 Portable, 3/60/ 220/440 New
1—125 KVA Hercules. 3/60/220/440/1500 Hrs.
2—45 KVA Chry. New 6 Cyl. 3/60/220/440.
1—200 KW G.M. Twin 6-71, 240 D.C. Rad. Cooled Elec. Start.

ELECTRIC MOTORS

Qu.	HP	Make	Type	Volts	Speed
1	1000	G.E.	K	2300	1800
1	1000	West.	CW	2300	450
1	700	West.	CW	440	1800
1	600	West.	CS	2200	600
1	500	Al. Ch.	Syn.	2300	212
1	500	AC	ARX	2300	1800
1	500	West.	CS	6600/2300	514
1	450	A.C.	ANY	2300	600
2	400	G.E.	IK	2300	1800
1	400	West.	CW	440	514
1	400	G.E.	Syn.	2300	450
1	350	G.E.	MT18	2300	400
1	250	G.E.	IM	2300	450
2	200	G.E.	KT559	2200	1200
1	200	West.	CW	440	1800
1	200	G.E.	IM	440	600
1	125	West.	Syn. 3.brg.	550	600
2	100	G.E.	KT352	220/440	1200
1	100	G.E.	KT543	440	1800
1	50	West.	CS	440	3600
1	50	West.	CS	440	1200

EXCEPTIONAL DELIVERY
New O'Brien mfrd. Red Line dry type Transformers to 150 KVA single phase, 300 KVA, 3 phase—4800 V. Pri.—& Phase Changers to 100 KVA.

TURBO GENERATORS

Philadelphia Stock

1—1250 KVA DeLaval Non-Cond. 3/60/2300. New 1940 240 p 50 lb. B.P.
1—780 KVA G.E.-Moore 3/60/2300/3600 RPM Non-Cond. 180 PSI 35 lb. B.P. New 1936.
1—500 KVA West. Non-Cond. 3/60/220/440, 150 PSI 10 lb. B.P.
1—200 KVA Moore Non-Condensing 3/60/480, 195 PSI, 100° F, 100# BP. Year 1936.
1—187 KVA West. Non-Cond. New 1930 3/ 60/440 110 psi 10 lb. B.P.
1—94 KVA Worthington Non-Cond. 3/60/220 140 psi 5 lb. B.P.
1—75 KW G.E. Non-Cond. D.C. 125 volt.

AIR COMPRESSORS

1—1600 CFM Sullivan WJ 8 Angle Cpd. 100 psi 22/13x16 belt.
1—978 CFM Sullivan 13x13x8, 45 psi.
1—900 CFM CP 100 lb. 9CP Portable Diesel Compressor, Pneu. tires.
1—528 CFM Ing. Rand 14x12, 100 psi.
1—215 CFM Penna 3A, 70 psi—V-Belt
1—368 CFM Chi. NSB, 12x10, 100 psi.
1—371 CFM Schramm 7½x5x4, 100 psi

OISC TRANSFORMERS

Qu.	KVA	Make	Pri. V.	Sec. V.	Phase
3	2000	Al Ch.	33000	2300	1
4	2000	West. (Sub-sta)	23000	2400 (NEW)	1
3	1000	GE	13200	2300	1
1	1100	West.	4160	440	3
3	667	Al. Ch.	33000	2300	1
3	500	West. (Dry)	33000	2300	1
3	500	West.	22000	460	1
1	500	Gregory	4160	440	3
3	500	GE	13200	2300	1
3	400	GE	2400	480	1
3	333	Pitts.	33000	2300	1
3	333	G.E.	13800	240/480	1
3	333	(New)	2400	480	1

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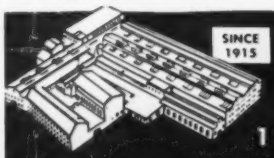

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Diesel Engines **Diesel Generators** **Turbo-Generators**
AC motors from 5 HP to 6000 HP • DC motors from 5 HP to 1500 HP
AC and DC Generators up to 4600 KW

Boilers	Turbines	Gear Reducers	Motor Starters
Condensers	Air Ejectors	Coolers	Heat Exchangers
Pumps	Compressors	Blowers	Vacuum Pumps
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Axial Flow Fans	Exhaust Fans		Diesel Engine Parts
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Welding Machines	Welding Rods		Pile Driving Hammers
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1000 KW DIESEL GENERATING SET

6 Cyl., Air Start, Bosch Inj. System, Nelseco Diesel Engine. 300 RPM, direct coupled to: General Electric AC, 1000 KW, 3/60/2300 volts, including: starting auxiliaries, switchboard, and spare parts.

Overhauled, ready to ship

VARIOUS OTHER MAKES & SIZES IN STOCK, AC & DC.

ALJON ELECTRIC DIESEL CO.
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MODERN 1000 KW Turbo-Generator

in excellent Condition

Non-Condensing, Steel case 80# back pressure .8 P.F., 3 phase, 60 cycle, 4150/2300 volts, alternating current, complete with accessories, switchboard, oil circuit breaker and direct connected exciter. Only operated alternately for six years. Ideal for Chemical, Rubber, Petroleum, Textile, Pulp and Paper, and Sugar Refining Industries.

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AUGUST 1953

CHICAGO Electric Digest

PUBLISHED BY CHICAGO ELECTRIC CO. · THE HOME OF GUARANTEED REBUILT POWER EQUIPMENT

POWER EQUIPMENT FOR ALL INDUSTRIAL NEEDS

SLIP RING MOTORS

3 Phase, 60 Cycle, 200 or 440 Volts (*2200 volts or higher)

HP	Make	Type	Speed
2000	*G. E.	MT-12	600
2000	*G. E.	MT-30	237
1500	*G. E.	MT-30	240
1250	*West.	CW	600
1000	*West.	CW	250
700	*A. C.	ANY	720
500	*G. E.	IM	3600
500	*G. E.	MTP	1800
500	*G. E.	MT	450
500	West.	CW	350
400	A. C.	3-brg.	450
400	*G. E.	MT412	450
350	West.	CW	900
300	*G. E.	IM13A	1800
300	*G. E.	MT410	450
250	West.	HF15H	600
200	G. E.	IM15	1200
150	G. E.	MT549 BB	1800
150	West.	CW772C	1200
125	*G. E.	MT549	1800
125	G. E.	IM15A	600
100	A. C.	ANY	900
100	G. E.	IM15A	450
75	Northw'n	HW50	1800
75	G. E.	MT347	1200
75	G. E.	MT356	900
75	G. E.	IM	720
75	G. E.	IM14	600
60	West.	CW762C	900
50	G. E.	IM11A	1800
50	*A. C.	ARY	1800
50	West.	CW636A	1200
50	G. E.	MT346	720
50	G. E.	IM14	450
40	*G. E.	MT352	1200
40	G. E.	MT336	1200
35	Fair-Mor.	UAB (vert)	1800
35	G. E.	IM	1200
30	G. E.	MT532	900

WE WILL BUY YOUR SURPLUS MOTORS
Hoists, Compressors, Transformers
CASH OR TRADE
Write full details for our OFFER BY RETURN MAIL

AC SYNCHRONOUS MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 volts or higher)

HP	Make	Type	P.F.	Speed
1420	*West.		.7	900
800	*G. E.		1.0	1800
710	*G. E.	ATI	1.0	720
700	*G. E.	TS975Z	1.0	1200
600	*G. E.	TS7640	1.0	900
600	*G. E.	TS	1.0	600
600	*G. E.	ATI	1.0	240
400	West.	HG	1.0	900
300	G. E.	ATI	.8	1200
300	G. E.	ATI	.8	900
300	G. E.	ATI	1.0	720
300	Ideal	SNS	1.0	257
250	*Cr-Wh	251S4	1.0	1800
220	*West.		1.0	600
190	El. Mhy.	2S	1.0	720
175	*West.	HR	1.0	360
150	*West.	HR	1.0	300
125	*G. E.	ATI	1.0	900
125	*El. Mhy.		1.0	900
125	*G. E.	TS	1.0	277
115	El. Mhy.	EM	1.0	240
100	*G. E.	ATB	.8	900
100	*West.		1.0	900
100	Ideal	SNS	1.0	900
100	G. E.	TS6184	1.0	450
20	Fynn-W.	15VRN		1200
15	Ideal			1800
15	Century	ARC365	1.0	1200
7½	Ideal			1800

M. G. SETS

KW	Make	AC	DC
2400	West. (3-u)	4800	525
1000	G. E. (3-u)	11000	137/275
1000	West. (3-u.)	11000	137/275
500	AC-West.	2300	250
450	G. E. (3-u.)	2300	125/250
400	A. C.	2300	120/240
300	Cr-Wh	440	250
200	G. E.	440	550
200	West.	2300	275
200	G. E.	440	600
150	G. E.	2300/440	250
150	G. E.	2300/4000	125/250
150	G. E.	440	275
125	G. E.	440	300
125	West.	440	250
100	G. E. (25 cy)	440	125
100	G. E.	2300	250
100	Ridgway	2200	275
100	West.	220	125
100	Elec. Machy	220	125
90	G. E.	220	250
90	G. E.	440	60
75	Reliance	2300/440	250
60	A. C.	2300	110
50	G. E.	440	250
40	A. C.	220	125
35	West.	2200	125
40	G. E.	220/440	250
25	Cr-Wh	440	125
20	G. E.	440	250
20	Bogue-GE	550	250
20	Bogue-GE	220/440	125
	DC TO AC		
100	G. E.	230	235
75	West.	2300	110
12½	West.	250	115

TRANSFORMERS

KVA	Make	Phase	Pri-mary	Second-ary
1000	West.	3	4800	480
850	West.	3	4160	455
667	G. E.	1	33000	480
500	American	1	2400	240/480
400	West. (air)	3	12000	213
300	G. E.	3	13800	240/480
300	G. E.	3	2400	240/480
250	G. E.	1	4160	240/480
200	Wagner	1	2400	575
167	A. C.	1	2400	120/240
100	Pittsburgh	1	2400	575
100	Pittsburgh	1	2400	240/480
100	American	1	2400	240/480
100	G. E. (Py'l)	1	2400	120/240
50	West.	1	2400	120/240

NEW Dry-type Transformers to order—to 150 KVA
1800 Standard or Special—Quick Delivery

D. C. MOTORS

Mill Type—Pedestal Bearing Reversing

HP	Make	Volts	Speed
1500	West.	525	600
1200	West.	525	600
1000	West.	450	600
	230 Volts—Constant Speed		
250	G. E. (550 v)	MPC4	700
200	Cr-Wh.	CM	500
175	G. E.	ELC	750
100	G. E.	RC34	2500
100	G. E.	RC19	575
100	West.	MC90	460
50	G. E.	RC35	700
50	G. E.	DLC-204	650
40	G. E.	CO2004	600
35	Cr-Wh.	CM351	700
30	Cr-Wh.	CCM	440
30	Sprague	C-60	240/300
25	West.	SK100L	1100
25	G. E.	RC32	900
25	G. E.	RC32	800
25	A. C.	E130	775
25	West.	SK133	575

Many others—1 HP and up
Also Variable Speed and 115 Volt Motors

AC SYNCHRONOUS GENERATORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 volts or higher)

KVA	Make	Type	P.F.	Speed
3500	*G. E.		.8	720
1750	*West.		.7	900
1500	G. E.	ATI	.8	720
312	G. E.	ATI	.8	900
300	*G. E.	ATI	.8	720
225	G. E.	ATB	.8	600
187	West.	ES	.8	720
100	*G. E.	ATB	.8	900
60	Fair-Mor.	B	.8	900
55	G. E.	ATB	.8	1200
50	G. E.	ATB	.8	1200
50	West.		.8	1200
50	G. E.	ATB	.8	900

CHICAGO ELECTRIC PROVIDES IDEAL SOURCE

For over 42 years, Chicago Electric has been of service to industry . . . furnishing modern electrical power equipment thoroughly rebuilt and fully gauaranteed at substantial savings over new equipment. Throughout these years, Chicago Electric has provided power equipment for mills, slitters, pulverizers, paper machines, machine tools, cranes and presses. Chicago Electric has often solved problems requiring prime moving equipment such as vari-volt drives or engine and turbo-generator sets. Remember, whatever you need in the field of electrical power equipment and whenever you need it . . . be sure to always call . . . CHICAGO ELECTRIC.

SQUIRREL CAGE MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 volts or higher)

HP	Make	Type	Speed
1750	*G. E.	K	3600
1000	*G. E.	K6347S	1800
750	*A. C.	TEFC	1800
750	*G. E.	KT	720
700	G. E.	FT	3600
500	*A. C.	6316SW	1800
400	*G. E.	KF559	3600
300	*West.	CS	3600
250	*L. Allis	OGX148	720
250	G. E.	IK	600
200	*G. E.	FT549Y	3600
200	A. C.	ARWX	3600
200	*G. E.	IK13B	1800
200	A. C.	ARWWT	600
200	G. E.	IK17	600
200	*G. E.	K6325S	514
150	A. C.	AR DP	3600
150	*A. C.	AN	1800
150	G. E.	IE-K	1200
150	*G. E.	KT566 TEFC	720
150	G. E.	IK16	600
150	*West.	CS 3-brg.	600
125	West.	CS5048	3600
125	*A. C.	AR226	1800
125	*Reliance	AA6085 BB	900
125	West.	CS856C	900
100	L. Allis	EX1148SExPr	3600
100	*G. E.	FT542Z	1800
100	*West.	CS	1800
100	A. C.	AW	1200
100	G. E.	IK13A	1200
100	U. S.	CFU (vert)	1200
100	*West.	CS (vert)	1200
100	*West.	CS774C	900
100	G. E.	IK15A	514
75	West.	CS445S	3600
75	G. E.	KT537	1800
75	G. E.	IK11A	1800
75	A. C.	AR505	1200
75	Howell	TEFC	1200
75	Fair-Mor	HO BB	1200
75	G. E.	KF542 BB	1200
75	*A. C.	AR (vert)	900
75	A. C.		900
75	A. C	AN	720
75	G. E.	IK	600
75	Fair-Mor.	H24B BB	514
60	G. E.	KF444Z	3600
60	*West.	CS5048	1800
60	A. C.	APZ445S TEFC	1800
60	*West.	CS5058 TEFC	1800
60	A. C.	APZ504U TEFC	1200
60	West.	CS752C	1200
60	A. C.	AR823	900

Hundreds of smaller Motors!
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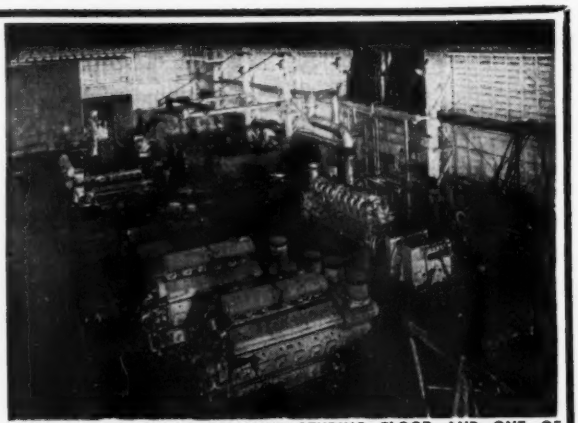

PORTION OF ENGINE REMANUFACTURING FLOOR AND ONE OF THE ENGINE TEST STANDS AT OUR SAUSALITO, CALIF. PLANT

A PARTIAL LIST OF OUR INVENTORY

KW	MAKE	MODEL	HP	RPM
1980	Nordberg	TS-217	3000	225
1136	Fairbanks Morse	38D	1600	720
1100	General Motors	16-278A	1600	720
1000	General Motors	16-567B	1440	720
750	General Motors	12-567	1080	720
500	General Motors	8-278A	750	720
500	Baldwin	VO-8	750	514
500	Alco	6-12½x13T	750	600
500	General Motors	8-567	720	720
480	Worthington	DD-8	700	360
400	Ingersoll-Rand	S-8	600	720
350	Baldwin	VO-6	510	450
320	Enterprise	DSG-6	460	450
300	General Motors	8-268A	450	1200
250	Fairbanks Morse	33-D	375	360
200	General Motors	8-268A	350	900
167	Ingersoll-Rand	S	255	600
160	Buckeye	80	240	600
150	Worthington	CC-4	225	450
100	General Motors	3-268A	150	1200
100	Worthington	BB-5	150	600
60	General Motors	6-71	90	1200

ALTERNATING AND DIRECT CURRENT UNITS
STANDARD AND SPECIAL VOLTAGES AS REQUIRED

ONE YEAR GUARANTEE!

ELECTRICAL EQUIPMENT
REBUILT N.I.S.A. STANDARDS

AC Motors — 3 phase 60 cycle

HP	Speed	Make	Wdg.	Type & Disc.
500(3)	1800	West.	Syn. 2300 V.	PedBrgW/Exc
450	1800	AC	SC 2200 V.	AW-8B
350	1800	AC	SC 2200 V.	AW-8B
200	1800	GE	SC	K6333S TEFC
150	1800	GE	SR	M-6328 TEFC
150	720	Allis-Chal.	SR	AR-Holst
150	720	West.	SC	CS
125	3600	Elliott	SC 2200 V.	9NS02
100	1800	GE	SR	IM
100	735	Allis-Chal.	SR (25 cy.)	ARY-3 Brg.
100	900	GE	Syn. 2200 V.	TS-DC Exciter
100(2)	1200	GE	SC	I-K
75	1200	Wagner	SC	24-W
75	900	West.	SR	CW-752C
75	900	AC	SC	AR-BB
75	900	GE	SR	IM
75	880	GE	SC 2200 V.	KT-558
60	1200	GE	SC	I-K
60(2)	3600	GE & W	SC	K&CS 4448B
60(3)	1200	Allis-Chal.	SR	ARY-505 BB
60	900	AC	SC 2200 V.	ARZ-TEFC
50	1800	GE	SC	IK
50	1800	FM	SR	HV-BB
50	1200	GE	SR	MT-334
50	900	GE	SC	IK
50	750	CW	SC	SC
50	600	CW	SR	SR
40	3600	GE	SC	K-405a Exp. Pr.
40	1800	GE	SC	KT
40(2)	1200	Rel.&West.	SC	Fr 445-BB
40(2)	1200	AC&Rel.	SC	TEFC-BB
40	900	West.	SR	CW
30(3)	1800	AC	SC	ARZ-TEFC
30	1200	AC	SC	ARZ-TEFC

SPECIALS

1—500 KVA Trans. West'hse Type A8L, 5% Imp. 13800/480 volts 75° Air Cooled. 2—150 KW West. M-G Sets 275 V. DC 3/60/3200 AC. 2—56RZ Falk Motorvitucers 125 RPM 50 HP Class II. Hundreds other motors and electrical Items in stock. Large stock new motors to 150 hp & Gearheads to 30 hp at rated discount—Freight allowed. SEND US YOUR INQUIRIES.

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735 So. 4th St., St. Louis 2, Mo. Phone — Chestnut 4603

LEA Offers You

M-G SETS—3 ph. 60 cy. Drive
1—750 KW G.E. 550V D.C. MPC., Syn. Dr.
1—500 KW G.E. 250V D.C. MPC., Syn. Dr.
7—400 KW West. SK. 125V. D.C.
2—200 KW West. SK. 250V. D.C.
2—150 KW West. SK. 250V. D.C.
1—150 KW G.E. 250V. MPC.
1—100 KW West. SK. 125V. D.C.
2— 75 KW West. SK. 125V. D.C.
95 other AC-DC Units

SQ. CAGE MOTORS 3 ph. 60 cy. 440 V
1—400 HP West. MS. 400 RPM

SQ. CAGE MOTORS
1—300 HP A.C. "AN" 1200 RPM
1—250 HP Ideal 900 RPM
1—150 HP A.C. T.E.F.C. 1800 RPM
1—150 HP G.E. I-K-17 450 RPM
500 Other Small Sizes

25 cy. 3/440 V SLIP RING MOTORS
1—800 HP, 1—600 HP
1—400 HP, G.E. 750 RPM
1—300 HP A.C. 500 RPM
1—225 HP G.E. I.T.C. 500 RPM
1—300 KVA Frequency Changer, G.E. ATI. 3 ph. 25 to 60 cy., or 60 to 25 cy. 440 to 440V.

Controls for the above can also be supplied . . . 4000 other units in stock. Write us.

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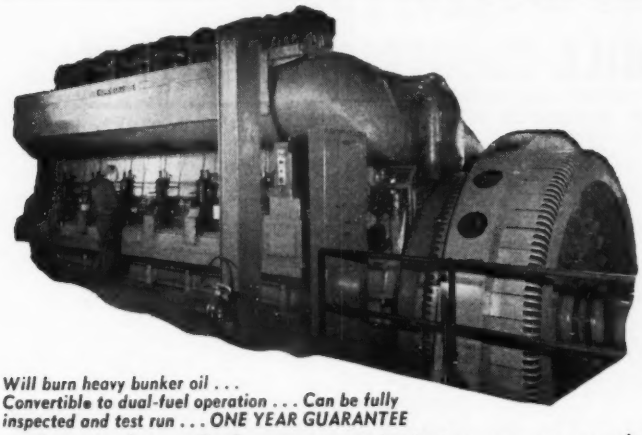
CURRENT MODEL · · DIESEL

1980 KW NORDBERG MODEL TS-217 DIESEL UNIT

Heavy Duty • Slow Speed • Available Immediately



Will burn heavy bunker oil . . . Convertible to dual-fuel operation . . . Can be fully inspected and test run . . . ONE YEAR GUARANTEE

ENGINE: (2800 BHP net) Nordberg, 7 cylinder, 2 cycle Diesel engine at 225 RPM, 21½" bore, 29" stroke, cylinders arranged vertical in line, solid injection.

GENERATOR: 1980 KW, 2475 KVA General Electric generator, 2400/4160/6900 volts, 3 phase, 60 cycle service at 225 RPM.

(50 cycle rating 1650 KW at 187 RPM)

UNIT AUXILIARIES AND ACCESSORIES

Complete standard engine auxiliaries and accessories including filters, strainers, pumps, gauge board, pyrometer, thermocouples, exhaust muffler, lubricating oil cooler, Young evaporative type cooler for jacket water cooling, thermostatic control valve, fuel oil day tank with transfer pump and oil meter, 2 lubricating oil storage tanks, lubricating oil transfer pump, Diesel-driven air starting unit, air tanks, air intake filter, special engine tools, all station piping, including flanges, adapters, valves, and fittings, for air intake exhaust, water, lubricating oil, fuel oil, and air. Generator and exciter control switchgear.

The unit above affords a rare opportunity to procure a complete, modern current model, heavy duty, slow speed diesel set at a great saving. It represents an offering which cannot be duplicated anywhere in the diesel market today.

Act now . . . Phone, Wire, or Write for Full Details

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125 Lbs.—150 H.P.—1933-1938
150 Lbs.—125 H.P.—1947
Fire Box Type—165 H.P.—125 Lbs.—1941
Package Type—10-15-50-60-100 H.P.
Heating Boilers—5000-8000-12000 Ft.
8000 Gal. Cement Lined Hot Water Heater
Oil Burner—150 G.P.H. #6 Oil, Rotary, Equal New.

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A FEW SPECIALS

BOILERS

Cleaver Brooks model OB25, 8600 lbs. steam, 200 lbs. pressure, Oil fired. "1949"

Combustion Engr. Premier #30, 250 HP semi-portable, steel encased, firetube, 150 lbs. pressure "1949"

1000 H.P. Combustion, 4 Drum, 200#
812 H.P. (2) Combustion, 4 Drum, 300#
400 H.P. BW 3 Drum, 160# "1949".
250 H.P. BW 3 Drum, 225# "1948".

TURBO UNITS, non-condensing

937 KVA GE 480/240 v.; 0/15# bp
625 KVA Al.Chal.-Elliott 480/240 v.; 0/15# bp
375 KVA Al.Chal.-Elliott 240/480 v.; 0/25# bp
125 KVA GE 240/480 v.; 0/30# bp

STEAM ENGINE UNITS (Uniflow)

375 KVA (2) Wghse.-Skinner, 3/60/600 v.
187 KVA Wghse.-Ames vertical, 240/480 v.
150 KVA GE-Skinner, 240/480 v.
75 KVA GE-Ames, 240/480 v.

DIESEL UNITS (Modern)

1136 KVA (4) FM, opposed piston, 720 rpm
1000 KVA Elliot-De La Vergne 200 RPM
125 KVA (two) General Motors 1200 rpm
438 KVA GE—Winton (General motors)
300 KVA Fairbanks Morse 277 rpm
220 KVA (2) Wghse-Buckeye "E" 400 rpm
187 KVA Ideal-Buckeye "E" 400 rpm

GAS ENGINE UNITS

250 KVA GE-Cooper Bessemer, 450 rpm, GS-6
750 KVA EM-Worthington, 360 rpm, DDG-8

POWER PLANT EQUIPMENT CO., INC. 39 Cortlandt St. New York, N. Y.

SIMPLE AS

You get Guaranteed Electrical Equipment when you know its REBUILT & TESTED BY HEMPHILL ELECTRICAL ENGINEERS

JLHC — *This seal says so!*

TRANSFORMERS—60 Cycle

Qu.	KVA	Make	Type	Ph	Voltages
1	1500	G.E.	Pyranol	3	4150x2400
1	1000	G.E.	Auto	3	4150x2400
2	750	G.E.	HT	3	4150x120/240
2	750	G.E.	H	1	4600-120/240
1	500	Kuhl.	OISC	1	4150x2400
2	400	Pitts.	OISC	1	4800/4150/2400 x240/480
3	333	Whse.	OISC	1	2400x575
1	333	G.E.	H	1	13200x220 440
2	300	G.E.	H	1	13200x440
4	200	G.E.	H	1	13200x440
1	200	G.E.	HT	3	2400x240
2	150	Pitts.	ODSC	1	240x120/240
3	50	G.E.	H	1	4800x120/240
3	50	A.C.	H	1	230x120/240
1	25	G.E.	H	1	460x120/240
1	20	G.E.	Novalux		2400 6.6 Amps
2	25	G.E.	H	1	575x115/230
	25	Nlag.	OISC	1	2400x480
8	7½	Electran Air		1	460-8-40

MOTOR GENERATOR SETS

Qu.	KW	Make	Speed	DC	AC
1	1000	G.E.	514	600	2300/4150 Syn.
1	1000	Whse.	720	600	2300/4150 Syn.
1	1000	Whse.	720	275	2300/4150 Syn.
1	300	C.W.	1200	230	3-unit 2400/4150SR
1	300	G.E.	1200	230	2400/4150SR
1	200	Whse.	900	250	2300/4150 Syn.
1	150	C.W.	1200	230	440 SC
1	150	3 Unit G.E.	1200	125/250	2300 Syn.
1	150	Whse.	600	125	4150 Syn.
1	125	C.W.	1200	125	2300 S.C.
1	100	G.E.	900	250	2300 Syn.
3	60	G.E.	1200	125	208 Syn.
2	30	G.E.	1200	125	440 SC

SYNCHRONOUS MOTORS

Qu.	H.P.	Make	Speed	Type	Volts
1	300	El. Mach.	720	TEFC	2200
3	200	Whse.	720		4150
1	175	G.E.	720	ATI	2300
1	150	G.E.	720	ATI	2300
1	150	G.E.	1800	TS	220
1	150	Whse.	900	1S1G	220

Qu.	H.P.	Make	Speed	Volts
1	150	A.C.	360	440
1	125	El. Mach.	900	4800
1	100	G.E.	900	2200

SLIP RING MOTORS

Qu.	H.P.	Make	Speed	Type	Volts
2	500	G.E.	1200	M	2400/4150
1	400	Whse.	450	CW	550
1	250	Whse.	600	CW	440
1	200	Whse.	600	CW	440
1	200	G.E.	600	MT	440
3	150	A.C.	1800	AY RW	2300
1	100	G.E.	1800	IM	220
1	100	G.E.	600	IM	440
1	75	G.E.	600	IM	440
1	60	G.E.	1800	MT	220

DC, 230 VOLT MOTORS

Qu.	H.P.	Make	Speed	Type
1	300	G.E.	1200	MPC
2	150	C.W.	900	WP
1	125	G.E.	1700	RC
2	75	C.W.	900	WP
1	30	C.W.	700	CM
1	35	G.E.	860	RC
1	25	Whse.	825	BK

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COMPLETE DIESEL PLANT

3—Fairbanks Morse units. 805 HP—556 KW; 690 HP—473 KW; 300 HP—200 KW. Model 33-E-14. 3/60/2400 volts. New 1940. Will sell all or part. With auxiliaries. Condition excellent.

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REFRIGERATION COMPRESSORS

300 Ton Freon

Ideal for large plant or office building

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- For every industrial and power application.
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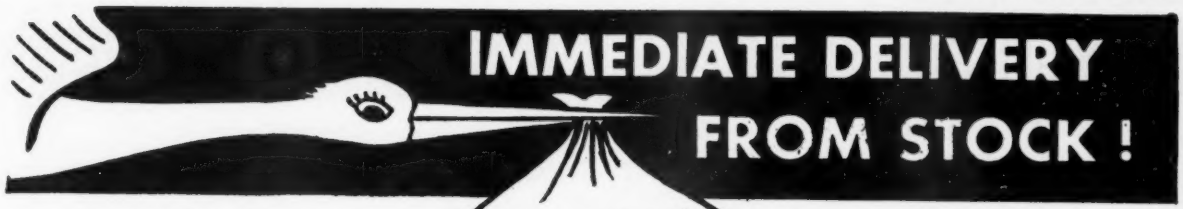


SQUIRREL CAGE, OPEN 3 PHASE MOTORS

HP	RPM	VOLTS	DESCRIPTION
750	900	6600	Westinghouse
350	3600	2200	Westinghouse
300	1200	2300/440	Westgh., CS
300	900	440	G.E.
200	490	2200	G.E.,-I
125	3600	220/440	A-C
125	1800	2200	A-C
115	1200	440	G.E.
100	1800	2200	Westinghouse
100*	1200	2200	G.E.-KF544
100	1200	2300/440	A-C, AR.
100	720	440	Westgh. 3 Brg
85	3600	2300	G.E.
60	3600	2200	G.E.
60	1800	2200	G.E.
50	3600	220/440	G.E.-404S
50	1800	220	Triumph
50	720	2200	Westinghouse
40	1800	220/440	West.-444
40	900	440	G.E.
40	720	440	G.E.
35	3600	220	G.E.-KT
15	600	440	G.E.

*New Motors

4 SPEED MOTORS AND CONTROL

Century, Model SCNM504Y901AV, 20 HP, 440 volt, 3 Phase, 60 Cycle, 1700/1120/870/560 RPM, Multi-speed, ball bearing. With plugging switch mounted on shaft; motors on adjustable hinge bases. Control —Allen Bradley, Magnetic.

SLIP RING MOTORS

HP	RPM	VOLTS	DESCRIPTION
400	514	440	West.-CW
375	1800	2300	Al. Ch.
350*	514	440	G.E., TE, FC, BB
300	514	440	Al. Ch. 3 Brg.
250	600	2200	G.E.-117B
250	450	2200	C.-W.
250	450	2200	G.E.-I-17B
250	300	2298	Al. Ch.
200	1800	440	Al. Ch.
200	600	440	West.-CW
200	600	440	G.E.-IM
200	514	440	West.-CW
150	1800	2200	FM-HV
150	720	2200	Al. Ch.
150	600	220	Wagner
125	1750	2200	West., CW
120	900	550	Ideal
100	720	440	Al. Ch.
100	600	2200	G.E. MT-582
100	600	220	Wagner
100	400	440	West. Elec. (GE)

*New

Special

FREQUENCY CHANGER

2500 KW General Electric
2300 volt, 3 phase, 25 cycle,
4000 volt, 3 phase, 60 cycle,
300 RPM.

MOTOR GENERATOR SETS

D.C. OUTPUT			A.C. INPUT		
KW	Voltage	Description	HP	RPM	Volts
1500	600	G.E., MCF	2100	720	13200
1200	525	Al. Ch.-G.E.	2000	720	2300
800	500	West., 3 unit	1200	1200	2300
800	250	Westgh.	1200	1200	2300
750	850	G.E.	1070	900	2300
750	500	Westgh.	1070	900	13200
750	250	Westgh.	1070	900	13200
600	250	Westgh. (2-300 KW Gen.)	1200	1200	2300
600	250	G.E.	900	900	2300
400	250	Westgh.-G.E.	600	1200	220/440
380	250	G.E.	450	1200	2300
200	125	G.E.,-Westgh.	300	720	2300
200	125	G.E. (25 cy.)	300	750	440
200	250	G.E.,-Westgh.	300	1200	440
100	250	Delco-Westgh.	150	1200	220
100	250	G.E.	150	1200	220/440
75	125	G.E.	115	1200	440
50	125	C-W	85	1800	440
47½	125	Al. Ch.	100	1200	2300
40	250	Westgh.-G.E.	60	1200	220/440
35	125	G.E.	50	1800	2200
22	125	Al. Ch.	33½	900	220
20	115	G.E.-Al. Ch.	30	900	220
15	250	Al. Ch.-L.A.	25	1800	220/440

PLATING AND ANODIZING SETS

D.C. OUTPUT AMPS	VOLTS	RPM	DESCR.	A.C. END HP	VOLTS	DESCR.
4000	2 to 8	425	Jantz & Leist			
2400	40/80	1200	Westgh.	290	440	WH Syns.
1500/750	6/12	1200	Munning			GE—
			Leeb	15	440	I Cage
1200	60	1160	Century	108	220/440	Century, SCN-584
1000	60	1200	Century	100	440	Century Cage
1000	6	1200	Wagner	—	—	—
800	30	900	C-W	40	220	C-W type 122Q
680	11	900	Westgh.	15	440	W.H. BB.
600	50	900	E-M	40	440	A-C
600	30	1200	W-E	30	440	GE
600	30	900	G.E.	25	440	GE
500	40	1200	G.E.	30	440	GE-KT
500	12	1200	Ideal	10	220	GE-KT
500	6		GE Rect.	—	440	—
416	12	1200	HVW	7½	440	GE-KT
400	40	1800	Hobart	25	220/440	Hobart
208	62	1800	G.E.	20	220/440	GE-KT

MEMBERS OF AMERICAN REBUILDERS ASSOCIATION, A MEMBER BODY OF AMERICAN STANDARDS ASSOCIATION

Glow Electric Company

927 HARRIET ST. CINCINNATI 3, OHIO PHONE MAIN 3024

FLUID DRIVE · GYROL TYPE VS HYDRAULIC COUPLINGS ● ● ●

Stepless speed variation with constant speed prime mover made by American Blower Co.
Ideal for pumping stations, steel mill drives, mechanical draft fans, crushers, rotary kilns, etc.
Wide range of capacities—Condition 98% new
200 HP to 2500 HP Input
300 RPM to 900 RPM Input
Complete data & quotation on request.
Also large selection of marine couplings, reduction gears, & Falk grid type couplings in stock.

A. G. SCHOONMAKER CO., INC.
50 CHURCH ST., NEW YORK 7, N. Y.

BOILER FEED PUMPS

1—Lecourtenay 675 G.P.M., Type 4M 8B, 5 stage, 1100 Ft. Hd.
1—Worth. 740 G.P.M., type WCS-2, 5", 2250 Ft. Hd.
1—Worth. 700 G.P.M., type UNS-1, 6 stage, 6". 1550 Ft. Hd.
2—I. R. 200 G.P.M., 2", 1375 Ft. Hd.

Pumps above are mounted on basis for motor or turbine drive.
We have about 200 various size cent. pumps on hand, turbine, motor, and gasoline driven. Send us your inq.

DALTON SUPPLY CO.
2829 Cedar St. Phila. 34, Pa.

NEW MOTORS! • STOCK SHIPMENT

ALL BALLBEARING

General Electric, Louis Allis, Reliance, Westinghouse. NEMA FRAME
Discounts from 60% to 65% Off on Items listed below.

25 CYCLE TEFC & EXPLOSION-PROOF (2G Label) 220-440 volts

Amt.	HP	Speed	Make	Frame
1	40	1500	G.E.	504U
2	30	1500	Rel.	445
1	30	1500	G.E.	445
2	25	1500	Rel.	405
1	25	1500	G.E.	444
1	15	1500	L.A.	405S
1	15	1500	G.E.	404
2	10	1500	L.A.	364
3	5	1500	L.A.	284

1/60/115-230 (1-D Label)

6	3	1800	L.A.	254
1	1½	1800	L.A.	225
6	1	1800	L.A.	224

2/60/220-440 OPEN DRIP-PROOF

2	15	3600	L.A.	324
1	10	3600	L.A.	284
1	10	1800	L.A. XP	326
1	7½	900	L.A.	326
2	5	1200	L.A.	284
3	1½	1200	L.A.	224
4	1	3600	L.A.	163
2	1	1800	L.A.	203

3/60/550—OPEN DRIP-PROOF

1	100	3600	G.E.	4458
13	40	3600	Rel.	4048
1	25	3600	G.E.	3648
5	5	3600	L.A. XP	225

BRAKE MOTORS

22	½	1800	L.A.	163

220/440 volts W/Size 5 C-H brake
Many larger brake motors also in stock.

3/60/220 GEARMOTORS

3—5/3.3/2.3/1.66 HP, 55/36/27/18 RPM, Whse, Frame FD324, parallel shaft output.
22—NEW Cleveland right angle worm gear reducers rated 5 HP—1150 RPM, 7.5 HP—1750 RPM, 6-1 Ratio, Series 215—50 RT Class 1

DRY TYPE TRANSFORMERS

5—50 KVA, NEW Westinghouse, Type AVR 480/240—240/120 volts

10,000 Other Motors in Stock
FHP Thru 1000 HP, New and Rebuilt

BENSON-WILIMZIG, INC.
1708 North 8th Street Garfield 4290 St. Louis 6, Missouri
PHONE — WIRE — OR WRITE

MOTORS • GENERATORS • TRANSFORMERS

T.E.F.C. MOTORS

2—200 HP West. XP-3/60/2200/3600, Frame 8120H.

1—125 HP G.E., TEFCBB, Frame KF63282, 60/3/440/3600 RPM.

1—60 HP Westinghouse X Proof, 3/60/220/440/875

60 HP West. CS-607 3/60/440/900, X-Proof.

1—50 HP Ideal TEFC, BB, 3/60/220/440/1800

50 HP Ideal, New, 3/60/220/440/1800.

1—30 HP Delco, TEFC, BB, 3/60/220/440/1745

1—25 HP G.E. TEFC, BB, 3/65/220/440/1750

1—25 HP G.E. TEFC, BB, 3/60/220/440/1170

2—20 HP Louis Allis ES-365, 3/60/220/440/1800, X-Proof.

1—20 HP Louis Allis, X Proof, 3/60/220/440/1750

15 HP Louis Allis Ex-364, 3/60/220/440/1800, X-Proof.

15 HP Louis Allis, X Proof, 3/60/220/440/1750

1—350 KW General Electric Generators Type MPC, 250 Volt DC, 720 RPM Single Bearing Machines.

MOTORS

60-50-25 Cycle in Stock—All Sizes. Slipring—Squirrel Cage—Synchronous. All types of Control Equipment.

100 HP Westinghouse Slipring 3 Bearing 3/60/220/440/435 RPM.

100 HP Gen. Electric Type I form K 3/60/2300/600 RPM.

100 HP Gen. Electric Type KT 356 3/60/2200/900 RPM.

125 HP Gen. Electric Type I form K 3/60/440/720 RPM.

125 HP G. E. Type KT 3/60/2300/1200 RPM.

150 HP G. E. Type KT 3/60/440/500 RPM.

150 HP Gen. Electric Type I form K 3/60/2300/900 RPM.

200 HP Gen. Electric Slipring Type I form M 3/60/440/600 RPM.

200 HP G. E. Type KT 3/60/440/600 RPM.

250 HP G.E. Type KT 3/60/440/720 RPM.

400 HP GEAR REDUCER

1—400 HP Nuttall (Westinghouse) Type LMR-25 Single Helical Heavy Duty Reducer—6-1 Ratio at 900 RPM with High Speed Shaft Extension for Brake.

400 HP SYNCH. MOTOR

1—400 HP Westinghouse Synchronous Motor. 3/60/2300/900 RPM. Unity P.F. with direct connected exciter—Late Type.

55" LIFTING MAGNET

1—55" Cutler Hammer Magnet 250 Volts DC. Excellent Condition.

125 VOLT DC MOTOR

1—100 HP Crocker Wheeler 125 Volt DC 850 RPM Ball Bearing

DC CIRCUIT BREAKERS

1—1000 AMP. Condit. 2 Pole

1—1600 AMP. Condit. 2 Pole

1—1600 AMP. Westinghouse 2 Pole

1—3000 AMP. Westinghouse 2 Pole

TRANSFORMERS

1—750 KVA Niagara New. Outdoor. 3/60/2400/208Y/120

3—500 KVA Westinghouse Type SL 1/60/33000/2400/4160Y—New 1947.

3—333 KVA Westinghouse O.I.S.C. 1/60/4800/480

6—50 KVA Niagara New—Day Type 1/60/240/480—120/240

ERIE ELECTRIC CO., INC. 124 CHURCH ST. BUFFALO, N. Y. CL. 4758

AMERICAN *50 Years' Record Guarantees Satisfaction*

- NEW AMERICAN AF—1 & 2 Stage Electric—Steam
- Rebuilts—Standard makes & sizes Stationary or Portable
- Rental—Gas—Diesel—Electric—Steam
- Rebuild or Convert your Compressor

PORTABLES

60 CFM Worthington (Gas) 2 PNEU
70 CFM Smith (Gas) 2 PNEU
105 CFM Worthington & Ingersoll
160 CFM Worthington (Gas) 2 & 4 PNEU
210 CFM Worthington (Gas & Diesel)
315 CFM IR & Worthington (Gas & Diesel)
500 CFM Worthington (Diesel) 4 PNEU
600 CFM Worthington (Diesel) 4 PNEU

STATIONARY

CFM	PSI	SIZE	MANUFACTURER
44	150	5x5	Ingersoll ER-I
66	110	6x5	Penn-IR
69	125	6x6	Ingersoll ER-I
88	60	7x5	IR-Penn
93	100	7x6	American-IR
122	100	7x7	Worthington-IR
136	125	8x8	American-IR
161	60	8x7	Ingersoll ES-I
166	135	8x9	IR-Worthington
187	40	10x6	Chicago NSB
211	100	9x9	Worthington HB
254	125	10x10	Chicago Pneu.
262	75	10x9	Worthington-HB
294	125	10x11	Ingersoll ES-I
311	40	12x8	CPT-Penn-IR
364	20	12x7	Worthington-IR
368	100	12x10	IR-CPT
370	40	12x9	Worthington HB
386	115	12x12	Ingersoll ER-I
426	100	12x11	Ingersoll ES-I
503	60	14x10	IR-Sullivan
528	100	14x12	CPT-IR
622	100	14½x13	American AF-I
740	40	17x10	CPT-IR
780	55	17x12	Ingersoll ER-I
868	125	17/10x12	Chicago Pneu.
1084	30	20x12	IR-CPT
1180	125	18/11x10	Chicago

America's No. 1
-COMPRESSOR REBUILDER
Since 1902

We have a unit for your requirements from our stock of over **300** compressors & vacuum pumps.

AMERICAN AIR COMPRESSOR CORP.
Dell Ave. & 47th St., North Bergen, N.J. · Union 5-4848

TRANSFORMERS FOR SALE

3—	1000 KVA Mol	11500—2400/4160Y
3—	500 KVA G-E	22000—2300/4000Y
3—	333 KVA W-H	13200—2400/4160Y
3—	333 KVA W-H	6600—2300
3—	333 KVA Mol	7200/12470Y—2400/4160Y
3—	250 KVA G-E	6600—575
3—	150 KVA G-E	19050/33000Y—2540/4000Y
2—	150 KVA G-E	6900—230/460
3—	100 KVA G-E	33000—6900—11950Y
3—	100 KVA G-E	13200—2300
3—	50 KVA A-Ch	33000—6900/11950Y
3—	50 KVA A-Ch	33000—2400/4160Y

Many other items in stock

TRANSFORMERS WANTED

Reliable rewind and repair service on all makes of transformers

THE ELECTRIC SERVICE CO.
CINCINNATI 27, OHIO
40 Years Dependable Service

1—2000 KVA, 3-60-33000-4160Y Westinghouse type CPS self-contained substations.
1—150 KVA, 3-60-13200-115/230 V. G.E. substation.
6—Section **NEW** G.E. switchboard consisting 2000, 600 and 350 A. drawout air breakers.
700 & 450 HP, 180 rpm, 4160V-3-60 **UNUSED** Syn motors.
1—37½ KVA 240/480 V., 3-60 Cat. Diesel set.

H. BLAINE JOHNSON & ASSOCIATES
53 W. Jackson Blvd., Chicago 4, Ill.

POWER PLANT MACHINERY

TURBINE GENERATOR UNITS
3 Phase 60 Cycle

32,500 KVA G.E. Cond. 250 lbs. 12000/13200 volts.
25,000 KVA G.E. Cond. 250 lbs 13200 volts.
7,500 KVA West Cond. 170 lbs. 2400 volts.
5,000 KVA G.E. Non-cond. Extraction 600 lbs.—125 lbs. extr. 50 lbs. exh. 13800 volts.
5,000 KVA G.E. Cond. 400 lbs. 2400/4160 volts.
5,000 KVA West. Cond. Extraction 400 lbs.—125 lbs extr. & 25 lbs. extr. 480 volts.
3,125 KVA West. Cond. 400 lbs. 2400/4160 volts.
2,500 KVA West. Cond. 200/400 lbs. 2400 volts.
2,250 KVA G.E. Cond. 400 lbs. 2400/4160 volts.
1,875 KVA G.E. Cond. 225 lbs 480. volts.
1,563 KVA G.E. Cond. 150 lbs.—15 lbs. extr. 480 volts.
1,250 KVA West. Cond. 400 lbs. 2400/4160 volts.
1,250 KVA West. (2) Cond. Extraction 250 lbs—125 lbs. extr. 480 volts.
1,250 KVA A.C. Cond. Extraction 300 lbs.—25 lbs. extr. 240/480 volts.
938 KVA G.E. (2 Non-cond. 150 lbs.—20 lbs. exh. 480 volts.
938 KVA West.-Terry Cond. Extraction 250 lbs. —45 lbs. extr. 480 volts.
625 KVA G.E. Cond. 400 lbs. 2400/4160 volts.
625 KVA G.E. Non-cond. 300 lbs.—5 lbs. exh. 480 volts.
187 KVA West. Non-cond. 150 lbs.—15 lbs. exh. 480 volts.
150 KVA G.E. (2 Non-cond. 150 lbs.—7 lbs. exh. 240 volts.

STEAM BOILERS

150,000 lbs. per hr. (3) B.&W., 250 lbs. stoker coal.
50,000 lbs. per hr. B.&W., 450 lbs. pulv. coal.
15,000 lbs. per hr. B.&W., 200 lbs. hog fuel.
10,000 lbs. per hr. B.&W., 425 lbs. stoker coal.

DIESEL GENERATOR UNITS
3 Phase 60 Cycle

1,250 KVA Nordberg, 2400 volts 257 RPM.
1,000 KVA McIntosh & Seymour, 480 volts 625 RPM
875 KVA Worthington, 2400 volts 327 RPM.
650 KVA Superior, 2400 volts 327 RPM.
625 KVA Cooper-Bessemer (New), 480 volts 600 RPM.
500 KVA (2) Fairbanks Morse, 2400 volts 400 RPM.
450 KVA (3) Alco, 480 volts 514 RPM.
425 KVA Fairbanks Morse, 2400 volts 400 RPM.
400 KVA (3) General Motors, 480 volts 1200 RPM.
375 KVA (3) Worthington, 2400 volts 327 RPM
375 KVA General Motors, 480 volts 1200 RPM.
312 KVA Superior, 480 volts 360 RPM.
250 KVA Worthington, 240 volts 327 RPM.
219 KVA (2) Ingersoll-Rand, 2400 volts 600 RPM.
150 KVA Fairbanks Morse, 240 volts 360 RPM.
150 KVA Worthington, 240 volts 600 RPM.
125 KVA Hercules, 440/220/127 volts, 1800 RPM.
112 KVA (2) Cooper-Bessemer, 2400 volts 450 RPM.
75 KVA Winton (gasoline) 240/480/2400 volts 1200 RPM.
62½ KVA International Harvester, 240 volts 1200 RPM.
37½ KVA General Motors, 240 volts 1200 RPM.

UNIFLO GENERATOR UNITS
3 Phase 60 Cycle

770 KVA Skinner horizontal, 150 lbs. 2400 volts.
750 KVA Ames vertical, 150-175 lbs. 240/480/2300/4160 volts.
500 KVA Skinner horizontal, 150 lbs. 240 volts.
375 KVA (2) Skinner horizontal, 150 lbs. 240/480 volts.
312 KVA Skinner horizontal, 150 lbs. 240 volts.
210 KVA Skinner horizontal, 150 lbs. 240 volts.
156 KVA Skinner horizontal, 150 lbs. 240 volts.

MOTOR GENERATOR SETS
3 Phase 60 Cycle

2,000 KW A.C. 2300 volts AC—250 volts DC.
500 KW (2) West. 2300/4160 volts AC—250 volts DC.
300 KW G.E. 2300 volts AC—250 volts DC.
200 KW (3) West. 2300/4000 volts AC—250 volts DC.
150 KW G.E. 2300/4000 volts AC—250 volts DC.
100 KW West. 2300 volts AC—250 volts DC.

ROTARY CONVERTERS
3 Phase 60 Cycle

3,250 KW G.E. 13800 volts AC—250 volts DC.
1,500 KW (2) West. 13200 volts AC—250 volts DC.
300 KW A.C. 13200 volts AC—250 volts DC.
150 KW (3) West. 6600/2300 volts AC—250 volts DC.

TRANSFORMERS
60 Cycle

10,000 KVA (1) A.C. 3 ph., 12000—2400/4160 volts.
6,000 KVA (1) Pgh. 3 ph., 11000—230 volts.
3,500 KVA (1) West. 3 ph., 33000—13800 volts.
3,000 KVA (1) Stand. 3 ph., 33000—4160 volts
2,125 KVA (3) G.E. 1 ph., 13200—2300/4000 volts.
800 KVA (3) Wgnr. 3 ph., 2400/4160—480 volts.
600 KVA (3) G.E. 1 ph., 11000—4000/2300/460 volts.
500 KVA (3) West. 1 ph., 33000—2400/4160 volts.
300 KVA (3) G.E. 3 ph., 69000—2400/4160 volts.
250 KVA (4) West. 1 ph., 33000—7200/12470 volts.
200 KVA (3) Ngra. (New) 1 ph., 2400/4160—240/480 volts.
150 KVA (3) G.E. 1 ph., 33000—7200 volts.
150 KVA (3) L.M. 1 ph., 7200/12470—2400 volts.
100 KVA (9) G.E. 1 ph., 33000—7200/12470 volts.
100 KVA (3) Pgh. 1 ph., 7200/12470—120/240 volts.
25 KVA (3) G.E. 1 ph., 2300—230/460 volts.

Write, Wire or Phone For Further Details and Prices.

INTERNATIONAL POWER MACHINERY CO.

UNION COMMERCE BLDG. Telephone: MAin 1-9514 CLEVELAND 14, OHIO

BOILER FEED PUMPS

We have just acquired these two boiler feed pumps which were installed new in 1950. They are in absolutely top condition.

1—DeLaval Boiler feed pump, rated 600 GPM at 1220 ft. head. Stainless steel fitted 3 stage single suction type 250 M-3P5/4, mounted on base and originally driven by 3600 RPM motor.

1—DeLaval Boiler feed pump, identical to the one listed above except mounted on base with 233 BHP steam turbine, 400 PSIG Steam pressure, 262°F superheat, 50 PSIG discharge.

TURBO-GENERATORS

CONDENSING

1—6250 KVA 5000 KW 3600 RPM Allis Chalmers 200 lbs. 100° SH. Will operate 275 lbs. 6150 TT without change. Generator 3/60/11500. Can be changed to 2400/4160. Complete auxiliaries. Can be operated for inspection. Checked by factory engineer in Sept. 1951—no repairs required.

1—1567 KVA 1250 kw 3600 RPM Allis-Chalmers 150 lbs. Will operate 200 lbs. 450° TT without change. Generator 3/60/2300. Complete auxiliaries.

1—1250 KVA 1000 kw 3600 RPM Westinghouse 185 lbs. 100° SH 3/60/2300. Completely reworked, generator has new winding. Complete auxiliaries.

1—937 KVA 750 kw 3600 RPM Gen. Elec. 150 lbs. Generator 3/60/2300.

NON-CONDENSING

1—1250 KVA 1000 KW 3600 rpm General Electric 140 lbs. turbine with type ATB Form T 3/60/2300, 80 pf, Synchronous Generator.

1—625 KVA 500 kw 3600 rpm General Electric 175 lbs. Single stage turbine with type ATB form T 3/60/2300, 8 pt. Synchronous Generator.

1—187½ KVA 150 kw Westinghouse geared 7200/900 rpm 150 lbs. 100° SH. Generator 3/60/240.

1—125 KVA 100 kw Westinghouse geared 7200/900 rpm 150 lbs. 3/60/240.

We will rewind these generators to your specifications

TRANSFORMERS

3 PHASE—60 CY.

1—2500 KVA 11500 to 480 Volt 3 Ph. 60 Cy. General Elec.
1—1800 KVA 6600 to 440 Volt 3 Ph. 60 Cy. General Elec.

1 PHASE—60 CY.

3—3333 KVA 66000 to 33000 & 132000 V 1 Ph. 60 Cy. Westinghouse

2—1000 KVA 13200-2300 v. 1 ph. 60 cy. Gen. Elec.
4—200 KVA 33000-2300/4600 v. 1 ph. 60 cy. Pittsburg
10—100 KVA 33000-2300/4600 v. 1 ph. 60 cy. Pittsburg
3—100 KVA 33000-2300/4600 v. 1 ph. 60 cy. Allis-Ch.
Large stock 2400/4160 Y.—120/240 v. 1 ph. 60 cy. Distribution Transformers

10—25 KVA
13—15 KVA
63—10 KVA
61—7½ KVA
65—5 KVA
20—3 KVA
13—1½ KVA

OUTDOOR INSTRUMENT TRANSFORMERS

2—110000/66000 to 110 volt Westinghouse Potential
13—33000/110 V. 200 V.—A GE E116 Potential
3—33000/110 V. Westinghouse Potential
2—60-120/5A 37 KV GE—K61 Current

OIL CIRCUIT BREAKERS—Outdoor

1—600 A. 110 KV GE FK0136
1—400 A. 73 KV West. G—1
2—400 A. 37 KV GE FK0136
1—400 A. 37 KV WEST. 0221
1—1200 A. 15 KV GE FHK0236

TAMPA ARMATURE WORKS INC.

401 S.MORGAN ST. TAMPA, FLORIDA PHONE 2-1966

SLIP RING MOTORS 3-Ph., 60 Cy.

HP	Volts	Make	Speed
600	2200	Whse.	450
500	2200/4000	G.E.	900
450	440	Whse.	514
300	440	G.E. (hoist)	600
300	2200/440	Whse. (new)	600
300	2200	G.E.	360
300	440	Whse.	3600
250	4000/2300	G.E.	450
250	440/220	Whse.	600
250	550/440	G.E.	1500
250	440	G.E.	600
200	440/220	Whse.	514
200	440	G.E.	450
188	4000/2300	G.E.	1800
150	2200/440	G.E.	600
150	550/220	G.E.	720
145	4000/2300	G.E.	1800
135	440/220	G.E. (hoist)	600
125	440/220	G.E.	900
125	550/440	G.E.	1200
125	2200	G.E.	600

SYNCHRONOUS MOTORS 3-Ph., 60 Cy.

HP	Volts	Make	Type	RPM
400	2200/440	G.E.	ATI	720
300	2300/400	G.E.	TS	720
300	2300/440	G.E.	TS	720
270	440/220	Whse.	HR	277
250	2200/440	G.E.	TS	1200
250	440/220	G.E.	ATI	600
240	2300/440	G.E.	ATI	720
225	440/220	Whse.	HR	360
200	4150/2300	Whse.	G	1800
125	440/220	Whse.	HR	400
120	440/220	G.E.	ATI	900
110	440/220	G.E.	TS	257
100	440/220	G.E. (25 cy.)	TS	575
75	2200/440	Whse.	GE	600

CIRCUIT BREAKERS

2—2000 amp., GG E., 3 pole, 600 v
2—1600 amp. ITE 3 pole, 600 v

200 KW GE RECTIFIER UNIT

1—new—Ignitron type, 250/275 V. DC, 4000 2300 V. AC, 3 ph., complete all accessories including transformer, switch gear, etc.

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
600	2200	G.E.	FT	3600
500	2200/4000	Elliot	SC	1800
350	2200	G.E.	KT	1200
350	2300	G.E.	KT	1200
300	2200	L. Allis	FS	1800
300	2200	G.E.	FT	3600
250	2200/440	G.E.	IK	720
225 (2)	2200/440	G.E.	KT	1200
200	2200/440	G.E.	K	1200
200	440	G.E.	IK	720
200	440	G.E.	IK	514
200	440/220	G.E.	KT	1800
200	2200/440	G.E.	IK	600
150	2200	Al. Chal.	AR	1800
150	220	Whse.	CS	1200
150	440	Multi sp.	KT	1800/600
150	440/220	G.E.	IK	450
150	440/220	G.E.	KT	720
150	440/220	Howell	B. Brg.	1800
150	440/2200	G.E.	IK	514
150	2200/440	G.E.	KT	600
125	440/220	G.E.	KT(vert.)	1200
100	2200/440	G.E.	K	1200

A. C. GENERATORS

1—320 kva, 660 rpm, 2300/440/220 V., G.E.
1—275 kva, 1200 rpm, 440 V., G.E.
1—250 kva, 720 rpm, 2300/440 V., G.E.
1—225 kva, 600 rpm, 220/440 V., G.E.
1—200 kva, 720 rpm, 2200/440 V., GE. (Ball brg.)
1—187 kva, 1200 rpm, 2200/440 V., Whse.

D. C. MOTORS

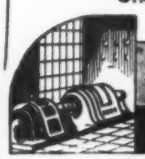
HP	Volts	Make	Type	Speed
250	230 (2 new)	Cr. Wh.	CMC	1800
200	230 (2)	G.E.	CD	1750
150	230	Whse.	SK	850
120	230	Whse.	SK	350/1050
100	230	El. Dyn.	30-3	475/1250
100	230	Cr. Wh.	CMC	625
90	230	G.E.	CD	1750
80	230	G.E.	BC	600
50	230	Rel	T	400/1200

MOTOR GENERATOR SETS

KW	Make	Input V., AC	Motor Type	Output V., DC
250	Whse.	2200	Syn.	250
175	G.E.	220/440	Syn.	230
150	Whse.	440	sq. ca.	250
100	Al. Ch.	2200/440	sq. ca.	240/120
100	Whse.	440/220	sq. ca.	125
75	G.E.	2200/440	syn.	125
65	G.E.	2200/440	sq. ca.	250
65	G.E.	2200/440	sq. ca.	125
60	G.E.	440/220	sq. ca.	250/125
45	G.E.	440/220	sq. ca.	250
40	G.E.	440/220	sq. ca.	250/125

TRANSFORMERS 60 CY.

3—500 kva, Whse., 24000—2300 V.
1—300 kva, Al. Chal. 4600/4160—240/120 V., 3 phase
3—200 kva, G.E., 11000—2300 V.
3—200 kva, G.E., 4150—480/240 V.
3—150 kva, G.E., 33000—2300/4600 V.
3—150 kva, Al. Chal., 2400—240/480 V.
3—150 kva, Al. Chal., 2400-240/120 V.
3—100 kva, Whse., 2400-240/480 V.
6—100 kva, Whse., 2400—120/240 V.
5—100 kva, G.E., 4150—120/240 V.
2—100 kva, Whse., 2400—120/55 V.
3— 75 kva, Whse., 2400—240/480 V.
3— 75 kva, Moloney, 4150—240 V.
3— 50 kva, Whse., 440—220/110 V.,
6— 50 kva, G.E., 2400—120/240 V.
11—50 kva, Whse., 2300-110/220 V., dry



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HARRY J. RICE PRES.

458 SEVENTH ST. HOBOKEN, N. J.

STEAM POWER PLANT

5—714 HP Combustion Engineering WATER TUBE BOILERS, with Ebasco Superheaters, Sturtevant High Pressure Economizers, Green Chain Grate Stokers, Hagan Combustion Controls, Copes Feed Water Regulators, Clarage Forced Draft Fans, Sturtevant Induced Draft Fans, Smoke Stacks. Good for 250# pressure by Hartford.
1—705 HP Stirling 4 drum Boiler with B&W Superheater, Green Chain Grate Stoker, Sturtevant Economizers, Sturtevant Induced Draft Fan, with Smoke Stack. Good for 250# pressure by Hartford.
2—8000 HP Webster Water Heaters.
1—McCaslin Pivoted Bucket Conveyor System for handling coal and ashes. Approximately 300' long.
6—Steel Coal Bunkers, 80 tons each.
1—30" Wheeler Single Stage Circulating Pump, 30,000 GPM direct connected to 300 HP Allis-Chalmers Motor, 3/25/440, 360 RPM. (Has extra impeller for 15,000 GPM)
1—4"x6" Dayton-Dowd Centrifugal Pump direct connected to 125 HP General Electric-Curtis Steam turbine.
1—100 KW General Electric 125 Volt DC Generator direct connected to a General Electric-Curtis Steam Turbine, 2-stage with reduction gear, Type SO, 3000 to 1200 RPM.
1—Type 1A-60 Wheeler Turbo Air Pump direct connected to 75 HP General Electric-Curtis 2-Stage Steam Turbine, 1750 RPM.
1—6" Wheeler Centrifugal Condensate Pump direct connected to a 20 HP General Electric-Curtis 2-Stage Steam Turbine, 1800 RPM.
1—Combination Circulating Pump and Condensate Pump driven by 190 HP General Electric single Stage Steam Turbine through a Westinghouse Reduction Gear, 3500 to 700 RPM.
1—2" 2-stage LeCourtney Centrifugal Pump, 200 GPM 650' Heat at 3700 RPM direct connected to 53 HP Westinghouse Steam Turbine.
1—3000 KVA General Electric Synchronous Converter, Type HCC, 6 phase, 25 cycle, 250 RPM, 600 Volts DC with 1—3150 KVA General Electric Transformer, 3 phase, 25 cycle, 6600/13200-445 Volts with starting panel and all instruments.
1—1000 KVA General Electric Synchronous Converter, Type HCC, 6 phase, 25 cycle, 750 RPM 600 Volts DC with 1-1050 KVA General Electric Transformer, 3 phase, 25 cycle, 13200/445 volts with starting panel and instruments.
1—300 KW Westinghouse Synchronous Converter, 6 phase, 60 cycle, 1200 RPM, 600 Volts DC with starting panel and instruments.
1—4000 KVA Westinghouse Transformer, 3 phase, 25 cycle, 13200/6600 volts.
7—700 KVA Westinghouse Transformers, single phase, 25 cycle, 7620/6600 volts to 13200 volts.
1—Kennecott Pressure Type Industrial Water Filter.
1—50-Ton Electric Traveling Crane—55'5½" Span.

Send for Complete Inventory

MORSE BROS. MACHINERY COMPANY

2900 BRIGHTON BLVD.

P.O. Box 1708, DENVER, COLORADO

NOW LIQUIDATING

AT MARION, INDIANA

1—Carbondale 10x10 Vert. twin cylinder Ammonia Compressor, 82 ton, 75 HP motor.

1—Taber Fermentation Gas Collector with 8 storage tanks 50 cu. ft., ASME 245# WP.

3—Niagara Spray Cooler and Fan Cooler Units.

1—Rotary Pump 5", with 40 HP motor, 1000 GPM—86' Hd.

12—Welded Steel Storage Tanks (closed) 10,500 gal., 11,300 gal. and 12,700 gal.

FOR SALE FROM PHILA. STOCK

2—I-R Motorblowers, type FS-538; cap. 4000 CFM @ 3# Pr.

1—Byron Jackson Bronze Deep Well Turbine Pump with 20 HP motor. 150 GPM.

1—I-R #1½-RVH Bronze Centrifugal Motor-pump with 20 HP motor. 200 GPM—200'.

PERRY EQUIPMENT CORP.

1422 N. 6th St. PHILA. 22, PA.

FOR SALE
18 NEW TURBINES

4 horizontal, 14 vertical, Westinghouse

Driving forced draft blowers—capacities ranging from 39000 to 56000 CFM and 16" to 24" pressure. Steam pressures 360 to 575#, back pressure 10#.

Will sell turbines separately if desired. *Price reasonable.*

Also—1—250 KW GE turbo generator unit, 3 phase, 60 cycle, 440 volt. Used one year.

G. M. DeROSE

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408 DONOVAN BLDG.
DETROIT 1, MICH.

PUMPS—COMPRESSORS—BLOWERS

4—2000-5000 GPM 32'-65', 10" & 12" Cent. Pumps
1—2000 GPM 350' Pump with 240 HP Turbine
1—1100 GPM 220' Allis-Ch. Cent. Pump
1—1000 GPM 280' all-bronze Cent. Pump
1—750 GPM 231' Pump with 75 HP 3 ph. Motor
2—600 GPM 360' Pump with 72 HP Turbines
1—200 GPM 556' Pump with 50 HP Turbine
1—Kinney unused 6" Rotary Pump, 450 GPM
3—Blackmer 6" rotary Pumps, 500 GPM
3—750 & 1000 GPM Knowles Steam Fire Pumps
1—8"x10" & 1—7"x8" Triplex Pumps
1—3"x8" Galland Hydraulic Triplex Pump
1—6"x10" Gardner duplex Pump, 300 GPM
1—12"x14" Duplex Air Compressor, 850 CFM
1—12"x10" I-R Air Compressor, 355 CFM
2—12"x9" Worth. Comp. 375 CFM Vac. & Press.
1—4-stage Norwalk Compressor 28 CFM 5000 PSI
1—GE Turbo-Blower 8500 CFM 16 oz., 58 H.P.
1—Sturtev. Turbo-Blower 7000 CFM 20 oz., 60 HP
4—Roots Blowers, size no. 710 AF, 400 CFM 5 PSI
1—Kinney Vacuum Pump, no. 12-8-14, 217 CFM
1—Beach-Russ no. 7 Vacuum Pump, 110 CFM
1—GE 2-stage Turbo-Blower 3000 CFM 16 PSI
1—Spencer Turbo Blower 4000 CFM 16 oz. 30 HP
12—Nash Vacuum Pumps & Vac.-Heating Units
1—DeLaval Steam Turbine, 125 H.P., 1750 RPM

HUNDREDS OF OTHER ITEMS—ALL SIZES ALL MAKES

SUPERIOR EQUIPMENT CO.

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STORAGE & PRESSURE TANKS

Located Mich.-Mo.-Fla., N.J. & Conn.

8—12,000-17,000 & 20,000 Gal. 90 Lb.
16—10,000-15,000 & 20,000 Gal. Storage
9—42,000, 120,000 & 240,000 Gal. Storage
10—10,000 Gal. Cap. RR Car Tanks

LESTAN CORP., ROSEMONT, PA.

USED 35 TON BRIDGE CRANE

75' span with 5 ton aux, 25' lift. Cab type 3/60/220 V. A.C.—used approx. 2 yrs. Mfg. Northern—*excellent condition.*

DAVE GORDON STEEL PRODUCTS, INC.
2411 35th St. Tampa, Fla.
P.O. Box 5033 Ph. 4-2367

2—325 HP FAIRBANKS-MORSE

Model 31A8½; 514 RPM; diesel engines bare; 4 yrs. old. Low price will astound you!

Send for stock list.

MIDWEST UTILITIES POWER EQUIPMENT CORP.
1270 Augusta Boulevard, Chicago 22, Ill.
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MOTORS—M. G. SETS—TRANSFORMERS

ENGINEERED AND REBUILT BY EXPERTS IN OUR OWN PLANT

SYNCHRONOUS MOTORS

Qu.	H.P.	Make	P.F.	Volts	R.P.M.
1	6000	G.E.	100	2300	90
1	3000	Whse.	80	4800/2400	720
2	2100	G.E.	100	2300	360
2	1750	G.E	100	2300	3600
1	750	G.E.	80	2300	450
1	600	G.E.	100	440	360
1	700	G.E	80	2300	720
1	250	G.E.	100	2300	514
1	200	Whse	80	440	1200
1	187	G.E.	80	440	720
1	150	G.E.	100	2200	900
1	150	G.E.	100	550	600
1	150	Whse.	80	220/440	450
2	135	G.E.	80	4000/2200	1200
3	125	El. Mchy.	100	4800/2400	900
1	125	G.E.	80	2200	900
2	100	Whse.	80	440	1800
1	100	Ideal	80	440	900
2	100	G.E.	80	440	600

With these we can supply—Manual, Semi on full magnetic reduced or full voltage control.

SQUIRREL CAGE MOTORS

3-Phase — 60 Cycle

Qu.	H.P.	Make	Type	Volts	R.P.M.
1	400	Cont.	NZ-808	2300	1200
2	400	G.E.	I-K	2200	1514
1	400	G.E.	KT-412	2200	450
1	300	Whse.	CS-890	2300	1780
1	200	Whse.	CS-873-C	2200	1200
1	200	Al.Ch.	ARY	440	600
1	125	Al.Ch.	AR	2200	1750
1	125	Al.Ch.	AR	2300	514
1	125	C.W	126-Q	440	430
2	100	Whse.	CS-663-C	440	1750
1	100	Al.Ch.	AR	550	720
1	100	Whse.	CS-938	2200	514
1	100	F.M.	H-241	440	450
2	75	Al.Ch.	AR	2200	1705
1	75	G.E.	I-K	440	600
1	75	Al.Ch.	AR	2200	720

Special—1 (new) G.E Vertical KF-574. 2200-Volt 580 R.P.M., enclosed, hollow shaft

MOTOR GENERATOR SETS

Qu.	KW	Make	RPM	Volts DC	Volts AC
1 (3-U)	2400	Whse.	720	600	4800/2400
1	1500	G. E.	600	600	4160/2300
3	1000	Whse.	514	600	11,000/6600
2	1000	G. E.	514	600	11,000/6600
1	750	Whse.	900	250	4160/2300
2	500	C. W.	720	575	2300/440
1 (3-U)	500	Whse.	1200	125/250	440
1	400	C. W.	1200	125/250	440
2	250	Whse.	1200	125/250	2300/440
1	200	Whse.	1200	275	4000/2300
1	200	Whse.	1200	125/250	4000/2300
1	155	G. E.	720	250	2300/440
2	150	Whse.	1200	125/250	440
1	100	Delco	1200	125/250	440/220
1	100	Ridgeway	1200	275	4000/2300
1	100	C. W.	1200	125	440/220
1	85	C. W.	1200	250	440/220
1	75	Al. Ch	900	250	2300
1	75	Whse.	900	240	2300
1	25	Ideal	1750	125	440/220
1	25	Al. Ch.	1200	250	440/220
3	20	Al. Ch.	1200	250	440/220
2	15	Al. Ch.	1200	250	440/220

We can furnish any of these sets with D. C. panels, A.C. starting equipment, exciter sets and other accessories.

Motor Generator Sets of modern design, complete with control—still on their original foundations—available for immediate shipment.
(3)—G. E. 1500-KW, 250-VDC, 514 R.P.M., spd., interpole, pole face windings, 2100-HP syn. motors, .8-PF, 13,200-V, 3-p, 60-cy. will reconnect to 6600-V. or 4160-V.

TRANSFORMERS (Power)

Outdoor—Oil Cooled

Qu.	KVA	Make	Type	Phase	Voltage
3	250	Packard	A	1	13200-2200
3	150	Packard	A	1	2300-230/460

3—833-KVA Westinghouse O.I.S.C. transformers, type S, one phase, 60 cycle, still on original foundation, primary 66,000 Volts with (4) 2½% taps below secondary 2300/4160-Y. Can ship immediately from location.

SLIP RING MOTORS—CONSTANT DUTY

3-Phase — 60 cycle

Qu.	H.P.	Make	Type	Volts	R.P.M.
1	1800	G.E.	MT 498	2300	257
1	1200	G.E	MT 26	2200	277
2	1000	Al.Ch.	ANY	2200	235
1	800	G.E.	MT	2200	440
1	600	G.E	MT 20	2300	360
1	500	Al.Ch.	ANY	2200	514
2	500	G.E	I-16-M	2300	450
1	400	G.E.	MT 412	2200	440
1	250	Whse.	CW 937	440	1200
1	250	Al.Ch.	ANY	440	720
1	250	G.E.	MT 414	2200	300
1	125	Whse	CW 870	2200	900
1	100	Whse	CW 766	440	1200
1	100	F.M.	H 20 C	440	900
2	100	G.E.	I-15A-M	2300	514

DIRECT CURRENT MOTORS

Qu.	H.P.	Make	Type	R.P.M.
1***	3000	Whse.	Encl. (Rev.)	600
1***	2400	Whse.	Encl. (Rev.)	600
4***	1500	Whse.	Encl. (Rev.)	600
4***	1200	Whse.	Encl. (Rev.)	600
4***	800	Whse.	Encl. (Rev.)	600
10**	700	Whse.	Mill	285/729
1	350	G. E.	CD-169	1150
1**	250	G. E.	MPC-6	325/975
1**	200/250	El. Dy.	Size 22	400/1200
1**	200	Whse.	Mill	300/1200
1**	200/250	G. E.	MPC	300/900
1**	180	G. E.	MPC	400
1***	125	Whse.	SK-190	600
1**	90/160	G. E.	MPC	625/1125
2	125	Whse.	SK-184	575/850
1	75	G. E.	CD-133	500/1000
1	60	El. Dy.	25-S	450/900
1	50	G. E.	RF-16	300/900
1	50	Whse.	SK	250/1000

All above are 230-VDC except where marked ***
***—Pedestal bearing mill type 525/600-VDC
**—Pedestal Bearing 230-VDC

T. B. MAC CABE COMPANY.

4314 CLARISSA STREET — Phone DAvenport 4-8300 — PHILADELPHIA 40, PENNA.

MOTORS MG SETS

Qty.	HP	Make	Voltage	Speed
12	3000	West.	525/600	600 RPM
26	1500	West.	525/600	600 RPM
32	1500	Al. Ch.	525/600	675 RPM
4	1200	Al. Ch.	525/600	650 RPM
2	900	Elliott	230	300/195 RPM
3	800	West.	525/600/600/300	RPM
1	650	Cr. Wh.	230	475/720 RPM
1	500	West.	230	250/500 RPM
1	400	G.E.	230	180/360 RPM
7	400	Elliott (new)	230	400/800 RPM
5	400	West. (new)	230	375/750 RPM
2	350	Cr. Wh.	230	400/800 RPM
1	200	Cr. Wh.	230	500/750 RPM
1	200	Cr. Wh.	230	375/750 RPM

All motors designed for mill reversing service.

Smaller sizes also in stock.

Motor Generator Sets in Stock 100—2000 KW Capacity

All of above is modern late type equipment remanufactured & tested by our engineers.

Write, Wire, Phone

All guaranteed for one year

A. G. SCHOONMAKER CO., INC.

50 CHURCH STREET, NEW YORK 7, N. Y.

Plants: SAUSALITO (S.F.) CAL., JERSEY CITY, N.J.

POWER PLANT EQUIPMENT

SPECIAL OFFERINGS

TURBO-GENERATORS

1—20,000 KW. 200# 13,200 V.
1—10,000 KW 200# 13,800 V.
1— 8,000 KW 275# 11,500 V.
1— 4,000 KW 400# 2300 V.
1— 3,000 KW 425# 13,200 V. Ext/170# Non Cond.
1— 3,000 KW 175# 550 V. Cd.
1— 1,500 KW 150# 2300 V. Cd.
1— 1,500 KW 175# 550 V. Ext.
1— 1,250 KW 250# 2400 V. Ext.
1— 1,000 KW 200# 4160 V. N.C. NEW 1949.
2— 750 KW 150# 250 V. D.C.
1— 500 KW 200# 4160 V. N.C.
1— 300 KW 125# 250 V. D.C.
2— 120 KW 150# 240 V. N.C.

DIESEL GENERATORS

1—1000 KVA 2400 volts
3— 500 KW 480 volts
1— 400 KW 480 volts
1— 300 KW 2400 volts
2— 75 KW 240/480 V.

BOILERS

2—50,000# 275# (1949)
3—15,000# 275# (1945)
1—400 HP Sec. Hd. 225#
1—300 H.P. 300# (1948)
1—84" HRT 150# (1942)

WATER WHEEL GEN.

1—180 KW 20 F.H. 550 V.

Write or wire for additional data and prints.

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THE BUYERS MUST BE SATISFIED—ALWAYS

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STEAM — ELECTRIC — HYDRO — DIESEL

"Export Orders Carefully Executed"

FOR IMMEDIATE DELIVERY

TURBO-GENERATORS—Condensing—500 to 40,000 KW; some extraction type, pressures 200 to 450#. *ON WHAT SIZE SHALL WE QUOTE?*
TURBO-GENERATORS—Non-condensing—300 to 3000 KW. 150# to 450# and 650#, some extraction with high back pressure. *WHAT SIZE INTERESTS YOU?*
STEAM GENERATORS—30000# to 100000# per hr. 150# to 450# and 650#.
BOILERS—Water Tube, Stirling & Straight Tube types 200 to 450#.
Special 2—500 & 1—770 H.P. B&W Co. Stirling Boilers 200#—excellent condition.
2—2000 H.P. B&W Sectional Header Boilers 250#.
BOILERS—Fire Tube, 100 to 300 HP. 100 to 250#. *WHAT BOILERS?*

TRANSFORMERS Quick Delivery. Various Sizes Rebuilt like NEW—Guaranteed. Motor-Generators, Rotaries, Frequency Changers, Large Motors & Diesel Generators.

Send us your **INQUIRIES** *for* **ALL POWER MACHINERY**

CHARLES B. REARICK — 30 CHURCH ST. — NEW YORK 7, N. Y.

DIESEL GENERATORS

240 volts 3 phase 60 cycles

1—100 K.W. Cummins—Westinghouse
1—100 K.W. Fairbanks Morse—E.M.
2— 50 K.W. Cummins—Burke Elec. Co.

Late models, with accessories, from excellently maintained power plant at Mt. Vernon, N. Y.

HUGH A. BROWN

Selling Agent

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DOUGLASTON 63, N. Y.

POWER EQUIPMENT

MOTOR STARTER

Whse. Slip-Syn 14-410 Tot. Encl. 600 HP 3/60 2200 V. Complete. Never Installed.

MERRILL and COMPANY

407 S. Dearborn St. Chicago 5, Ill.
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MOTOR GENERATORS

2—500 KW Westgh. 4160/2300—275 v—1200 rpm
1—150 KW G.E. 4003/23000 v—250 v—1200 rpm
2—150 KW Westgh. 2200 v—275 v—900 rpm

AIR COMPRESSORS

1884 ft. CHICAGO PNEU. OCE 2300 V.
676 ft. WORTHINGTON 3/60/220/440 V
3—JOY 445' & 512'—220/440 V

DARIEN, 60 E. 42nd Street, New York, N.Y.

SLIP RING MOTORS

220 or 440 volt, 60 cycle, 3 phase, slip ring Motors Rebuilt

H.P.	Make	Type	Speed	Description
400	G.E.	I-M	1200	S.B.
300	G.E.	I-M	1200	S.B.
200	G.E.	I-M	1200	S.B.
150	G.E.	I-M	1200	S.B.
150	G.E.	I-M	1800	S.B.
100	G.E.	MT-300	1800	S.B.
100	G.E.	I-M	900	S.B.
100	G.E.	I-M	720	S.B.
75	G.E.	MT-343	1200	S.B.
75	G.E.	I-M	900	S.B.
75	West.	CW	720	S.B.
75	G.E.	I-M	720	S.B.
60	G.E.	MT-333	1800	S.B.
40	G.E.	I-M	1800	S.B.

BRAND NEW SQUIRREL CAGE MOTORS

Totally enclosed, fan cooled, explosion proof, open 220 or 440 Volt, 60 Cycle, 3 Phase

H.P.	Make	Type	Speed	Description
150	G.E.	K-6326	3600	TEFCBB
150	G.E.	K-6326	1800	TEFCBB
125	G.E.	K-6326	1200	TEFCBB
100	West.	CS-6075	1800	TEFCBB
100	West.	CS-504	1800	B. B. open
75	West.	CS-504	3600	TEFCBBXP
75	A.C.	ARZ	1800	TEFCBBused
75	West.	CS-504	1800	TEFCBBXP
75	West.	CS-445	1800	B. B. open
75	F.M.	QS-445	1800	B. B. open
75	West.	CS-505	1200	TEFCBBXP
60	West.	K-5945	1800	TEFCBBXP
60	G.E.	OG-44	1800	TEFCBBXP
60	L.A.	QS-444	1800	B. B. open
60	F.M.	FB-404	3600	B. B. open
50	Master	K-445	1800	TEFCBBXP
50	G.E.	K-405	1800	TEFCBB
50	G.E.	CS-445	1200	S. B. drip
50	West.	K-505	900	S. B. open
50	G.E.	AR-444	3600	TEFCBBXP
40	A.C.	KF-365S	3600	TEFCBBXP
40	G.E.	CS-405	1800	B. B. Splash
40	West.	K-405	1800	TEFCBB
40	L.A.	404	1800	TEFCBBXP
40	G.E.	CS-5045	1800	B. B. open

REBUILT SQUIRREL CAGE MOTORS

220 or 440 Volt, 60 Cycle, 3 Phase, Open

H.P.	Make	Type	Speed	Description
200	Wagner	RP-2-26	1800	S. B.
200	Wagner		1200	S. B.
200	G.E.	K-564	900	B. B. new
150	West.	CS	1800	S. B.
150	G.E.	I-K	1200	S. B.
150	G.E.	I-K	720	S. B.
100	West.	CS	1800	S. B.
100	G.E.	I-K	1800	S. B.
100	G.E.	I-K	1200	
100	G.E.	KT-347	1200	S. B.
100	West.	MS	1200	S. B.
100	West.	CS	900	S. B.
100	G.E.	I-K	720	S. B.
75	West.	CS	1800	S. B.
75	West.	CS	1200	S. B.
75	G.E.	I-K	900	
75	G.E.	KT-343	1200	S. B.
75	West.	CS-WL-607	1200	S. B. B.
75	G.E.	KT-552	900	S. B.
75	G.E.	KT-352	900	S. B.
75	G.E.	KT-346	720	S. B.
60	G.E.	KT-333	1800	S. B.
60	G.E.	I-K	1200	S. B.
60	West.	CS	1200	S. B.
60	G.E.	KT-346	900	S. B.
60	G.E.	I-K	900	S. B.
50	G.E.	I-K	1800	S. B.
50	Cr. Wh.	25R	1800	S. B.
50	G.E.	KT-327	1800	S. B.
50	G.E.	KT-336	1200	S. B.
50	West.	CS	1200	S. B.

We have in stock explosive proof motors 220/440/60/3 ranging in HP from ½ to 50 HP 900 to 1800 RPM. We also carry in stock a large quantity of used electric motors from 1 HP up to 500 HP., generators, transformers and control equipment. Upon receipt of your inquiries, we shall be glad to quote.

POWER EQUIPMENT COMPANY

8 CAIRN ST., ROCHESTER 2, N. Y.

P. O. BOX 534 — Tel: Genesee 5629

STEAM POWER PLANT

VICINITY, JOHNSTOWN, PA.

3—45,000 #/hr. B&W Pulverized Coal Boilers 275 psi 500° TT 1937

1—5,000 kw 2300/3/60 GE Turbo-generator with Worthington Surface condenser.

1—2,500 kw 2300/3/60 GE Turbo generator with Wheeler Surface condenser

also exciters, feed pumps, spray pond pumps and other accessories.

Buy All Or Part

M. GLOSSER & SONS, INC.
80 MESSENGER STREET
JOHNSTOWN, PA.

DIESEL ELECTRIC PLANT

520 HP, FM Mod. 31-A-8½-AC, 514 RPM, 412 KVA, FM, Type TGZJ, 3/60/2400, Generator. Switchboard and complete plant auxiliaries. New 1948. Used less than 2100 hours.

DELL STEPHENSON & COMPANY
14456 GLASTONBURY
DETROIT 23, MICHIGAN

DIESEL-ELECTRIC UNITS and ALL AUXILIARY EQUIPMENT

NOW OPERATING — AVAILABLE AUGUST, 1953

1—McIntosh & Seymour, 925 hp, 225 rpm
Ideal Generator—750 kva, 480 volt, 60 cycle, 3 phase
Ideal Exciter—15 kw, 125 volt
1—McIntosh & Seymour, 625 hp, 225 rpm
Ideal Generator, 500 kva, 480 volt, 60 cycle, 3 phase
Ideal Exciter—15 kw, 125 volt
1—Alco, 8—12½ x 13 supercharged, 600 rpm
G.E. Generator—1000 kva, 480 volt, 60 cycle, 3 phase
G.E. Exciter—10 kw, 125 volt
Complete Auxiliary Equipment including Switchboards.

FS-8581, POWER
330 W. 42 St., New York 36, N. Y.

COAL SCALE

Used Richardson Automatic Coal Feeding Scale. 200 Pounds Per Dump. 15 Tons Per Hour. 1-16" Square Stock Coal Gate.

BURFORD, HALL & SMITH
140 Edgewood Avenue, N. E. WA-8890
Atlanta, Georgia

NEW TRANSFORMERS—25 & 50 KVA

GE, OISC, Distributor, Type "H", Form KO2, single ph., 50/60 cyc., 33,000 volts primary, 2400/4160 Y secondary, with 4—2½% taps below 33,000 volts, primary cover mounted bushings, secondary tank-wall mounted bushings. S/N 6,900,000.

American Electric Service & Maintenance Co.
Paramount & 2nd Sts., Springfield, Mass.
2-2104; 2-2105
Motors • Generators • Transformers • Sales • Repairs

TURBINE GENERATOR SETS

1—125 KVA GE AC 3/60/220 Volts/1200 RPM
1—250 KVA Elliott AC 3/60/220 Volts/1200 RPM
4—500 KW West. DC/120-240 Volts/1200 RPM

DIESEL ENGINES & GENERATING SETS

20—G.M. Quads (Navy Re-processed)
2—Hamilton (600 HP 720 RPM w/Dir. Con. Blowers Air Start Dir. Rev.
3—GM 8-268A w/100 KW West. AC 440V/1200 (WILL SELL PARTS & GENS. SEP.)
1—G.M. 2-268A 500 HP Marine Propulsion Engine w/rev. reduction gear & access. excell.
1—Cooper-Bessemer FS8 500 HP 900 RPM
* 2—Hercules DWXD w/Heat Ex. & Clutch
* 1—Worth. DD8 w/500 KW GE 3/60/230V
* 2—GM 8-268A w/200 KW West. 3/60/440V/1200

SYNCHRONOUS MOTORS

** 4— 75 HP Burke 3/60/220-440V/1800
** 2—125 HP El. Mach. 3/60/4800V/900
15—135 HP GE 3/60/4000 V/1200 TS963Z
* ** 1—200 HP El. Mach. 3/60/208V/1200
* 1—350 HP El. Mach. 3/60/208V/1200

AC & DC GENERATORS

* ** 75— 3 KW GE 3/60/120-208V/1800 w/Panels
* ** 35—5 KW I & 3/60/120-208V/1800/IBRT
* ** 50—10 KW GE 3/60/120-208V/1800 w/Panels
* ** 8—25 KVA GE 3/60/440V/1800
2—56 KVA Star 3/60/120-208V/1200
1—75 KVA El. Mach. 3/60/440V/900
2—500 KVA El. Mach. 3/60/440V/900
** 4—25 KW West. DC/125V/1800 2 Brg.
4—500 KW West. DC/120-240V/1200
*UNUSED—**BALL BEARING

ALBERT HELLER CO.
210 Snediker Ave., B'klyn 7, N.Y. HYacinth 5-0800

2—80 HP Erie Economic Boilers—1942
1—100-250-300-500 HP Package Boilers
1—400 HP Slp. Rg. & 300 HP Sq. C. Motors
1—60" Economy & 36 PC Logemann Balers
2—QUONSET HUTS—20'x56' & 20'x110'
1—UD24 Power Unit—good as new
1—10' D&K Shear & 10' Power Brake
1—1000 KVA Generator—720 RPM

H. & P., 6719 Etzel, St. Louis 14, Mo.

2—75 KW GENERAL ELECTRIC 3 WIRE M.G. SETS

GENERATOR: 75 KW, type CD 1242, 250/125 volts, 1200 RPM, Compound Wound.

MOTOR: 125 HP, type K-5362, 3 phase, 60 cycles, 220/440 volts, 100 RPM, Squirrel Cage.

Complete with DC Panels & AC (220 volts) Reduced Voltage Automatic Starters.

EMPIRE ELECTRIC CO., INC.
5202 1st AVE. • BKLYN 32, N. Y.

FOR SALE

ONE BIGELOW 50 H. P. BOILER

2-pass, Petro oil burner, controls, pump, valves, etc., fully automatic.

KENYON'S CLEANING CO.
Westerly, Rhode Island

If there is anything you want that other readers can supply

OR . . . *something you don't want*— that other readers can use—

Advertise it in the SEARCHLIGHT SECTION

DIESEL PARTS

Series 71
278A-268A
12-567 ATL
Hercules—Buda
FM 38D—8⅛
Caterpillar

Price list on request

RODER-BLACKBURN
INTERNATIONAL CORPORATION
Dept. P3, 149 B'way, New York 6, N. Y.

FOR SALE

(6) OIL FIRED B&W BOILERS

Cross Drum Sinuous Headed straight tube type. Heating surface 11417 sq. ft.—1141.7 HP—210 P.S.I.G. design pressure—200 P.S.I.G. working pressure—75,000 lbs./hr. capacity—steam temp., saturated—1024 cu. ft. furnace volume —200° feed water temperature.

(2) B&W WATER TUBE BOILERS

ASME code—from ATR tug—built 1943. 15,000 lbs. steam/hr./unit (normal) 18,000 lbs. steam/hr/unit max. Design pressure—268 lbs/sq. in. —total steam at drum outlet (saturated) 409 —forced draft—turbine driven blowers—1508 sq. ft. boiler heating surface. Gas or oil.

(4) 300 KW G.M. 8-268A DIESEL GEN.

G.M. diesel generator sets—120/240 volts DC —1200 RPM—1250 amps.—8 cyl. 6½x7—with switchgear.

(1) 30 KW G.M. 3-71 DIESEL GEN.

GM 4½x5 2 cyl. diesel—radiator cooled—electric starting. Delco 440/3/60 generator—with switchgear. Skid mounted—portable.

(2) 100 KW GM 3-268A 440/60/3 AC generator sets.

(1) 100 KW LORIMER 440/60/3 AC generator set.

(1) 100 KW FAIRBANKS-MORSE opposed 440/60/3 AC generator set.

(6) 300 KW TURBO GENERATOR SETS

120/240 volts DC—Joshua-Hendy turbine—250 lb. W.P. condensing. Suitable for pressures to 440 lbs. at 740°TT. Geared to 1200 RPM. 300 KW Westinghouse 120/240 volt 1250 amp. stablized shunt generator. With switchgear. Built 1945. Excellent condition.

(1) SUPERIOR HEAVY DUTY DIESEL

510 HP at 360 RPM—5 cylinder—14½x8—type ZDSB—non-reversing—vertical—4 cycle—cold starting—mechanical injection. Engine totally enclosed. For heavy duty pumping, dredge service, power generation, textile & saw mills, etc. Excellent condition. Immediate delivery.

ELECTRIC WINCHES

50 HP—230 volts DC—built in controls—5 ton and 10 ton.

THE BOSTON METALS CO.

313 E. Baltimore Street
Baltimore 2, Md.
Curtis 7-5050

3—400 K.V.A. General Electric Transformers Serial numbers 4347375-6-7 completely rebuilt in July, 1952. Transformers type H, Form KS, 60 cycles, voltage rating 2300, 230/460. Have 55°C rise, polarity-subtractive, circular coil H design, weigh 5900# each, impedence volts 3.67%. Offer to highest bidder.

HARTFORD CITY PAPER CO.
Hartford City, Indiana
SUBJECT TO PRIOR SALE.

General Motors—Elliott 1000 KW semi-portable diesel-electric generator sets (3), practically new, 2400/4160 v., complete with controls.
Nordberg-G.E. 875 KW diesel generator set, 257 rpm, 2300 v., 1250 HP, complete.
Allis-C 625 KW turbo-generator set, cond., 410 v.
1500 KW McI-Seymour-G.E. diesel-elec. gen. set.
Locomotives, 7 to 80 tons, diesel, gas, steam.
Whirley portal gantry cranes, 35-50 tons.

H. Y. SMITH CO.
828 N. Broadway — Milwaukee 2, Wis.

A. C. MOTORS
220/440 Volt 3 Phase 60 Cycle

HP	Make	RPM	Type
525	Elliott	720	Syn.
450	Elliott	720	Syn.
400	West.	600	CS-2200
350	West.	450	CS-2200
350	West.	585	CS-2200
350	G. E	720	Syn.
300	West.	450	CS-2200
300	West.	400	CS-2200
250	G. E.	1790	KF-2200
225	Elec. Mach.	1800	Syn.-2200
200	West.	291	CS-2200
200	G. E.	1800	Syn.-2200
200	Wagner	1800	2-RP2
150	West.	257	Syn.
150	West.	600	Syn.
150	Cr. Wh.	860	
150	Wagner	1200	
150	Reliance	1750	
150	G. E.	1750	2-Vert-2200
150	G. E.	1775	KF-2200
150 NEW	West.	1760	2-CS-BB-2200
150	Wagner	1800	TE NV
125	West.	1725	CS-761C
125	Cr. Wh.	720	
125	Elec. Mach.	164	Syn.
125	Wagner	1200	2-RP2
100	Cr. Wh.	600	
100	West.	860	CS-2200
100	Wagner	860	
100	G. E.	900	2-I-M
100 NEW	Reliance	1170	BB
100 NEW	Reliance	1170	TE FC
100 NEW	Reliance	1760	TE FC
100 NEW	Reliance	1765	BB
100	West.	1750	CS-663C
100	West.	1800	2-Syn.
75	Wagner	1200	
75	West.	690	2-CS-2200
75	West.	690	2-CS
75	Elec. Mach.	900	Syn.
75 NEW	Reliance	875	BB
75 NEW	Reliance	1170	BB
75 NEW	Reliance	1170	TE FC
75 NEW	Reliance	1800	BB
75	Century	1750	
75	Louis Allis	1775	SP BB
75	G. E.	1800	I-K
75 NEW	Reliance	1750	TE FC
60	G. E.	450	I-K
60 NEW	Reliance	1165	TE FC
60 NEW	Reliance	1755	BB
50	G. E.	680	KT
50	Ideal	870	SP BB
50	West.	900	CS-550
50	All. Chal.	865	550
50	West.	870	CS
50	G. E.	1150	KT-336
50 NEW	Reliance	1165	BB
50 NEW	Reliance	1165	2-TE FC
50	G. E.	1745	KT-333
50 NEW	Reliance	1755	BB
50 NEW	Reliance	1755	TE FC
50 NEW	Reliance	1760	2-TE FC-2200

VARIABLE SPEED MOTORS
230 Volt D. C.

HP	Make	RPM	Type
400	G. E.	400/1200	3-MPC
350	G. E.	300/900	CLC-185
250	Cr. Wh.	250/900	CCM
50	G. E.	500/1500	RLC
50	West.	350/1050	SK
40	Reliance	400/1600	TE FC
35	G. E.	500/1500	RLC
35	West.	250/1000	SK-131
30	Reliance	400/1600	TE FC

SLIP RING MOTORS
220/440 V. 3 ph., 60 cy.

HP	Make	RPM	Type
1000	G. E.	600	MT-2200
750	G. E.	400	MT-2200
400	West.	438	CW-2200
350	G. E.	710	MT
200	West.	500	CW
200	Cr. Wh.	590	2200
200	G.E.	600	I-M-2200
75	Fairbanks	600	
75	All. Chal.	605	550
60	G. E.	570	MTC
50	All. Chal.	690	
50	G. E.	865	MT
50	G. E.	1150	MT
50	West.	1150	CW

750 HP—25 Cy.—Slip Ring Motor
750 HP, 2200 V., 3 Ph., 25 Cy., 375 RPM, Fr. 445, G.E. Type MT8, Form A.

TRANSFORMERS—1 ph. 60 cy.

Qu.	KVA	Make	Primary	Secondary
1	250	Packard	2300	230
1	250	G. E.	2400	480
1	200	Pittsburgh	4600	115/230
2	200	All. Chal.	22000	2300
1	150	Pittsburgh	4600	115/230
2	100	Uptegraff	230	115/199
6	100	Pittsburgh	4600	115/230
3	75	Standard	2300	115/230
1	75	Pittsburgh	4600	115/230
1	75	All. Chal.	2400	240/480
1	75	West.	13200	2300
2 NEW	37½ 3 Ph.	Maloney	2400	240

G. E. RECTIFIER TRANSFORMER
890 KVA, 1110 KVA, 2 Hrs., Type HTH, Form D, 2300 V. Pri., 242 V. Sec., 6.74% Imp.

DUQUESNE ELECTRIC & MFG. CO.
Cor. Broad St. & Hamilton Ave.
Pittsburgh 6, Pennsylvania
Partial Listing — Write for Stocksheet

POWER EQUIPMENT

TURBINE UNITS

1—5000 KVA G.E. 3/60/2300/4000 V. 3600 RPM STRAIGHT CONDENSING nozzled for 450 psig 750° TT. Surface Condenser.

1—1250 KVA Al. Ch. 3/60/480 V. 3600 RPM, Terry EXTRACTION turbine nozzled 250 psig 550° TT 40,000# extr. 25 psig. Surf. Cond.

1—938 KVA West. 3/60/480 V. 3600 RPM, Terry EXTRACTION turbine nozzled 250 psig 500° TT 10,000# extr. 50 psig. Surf. Cond.

1—375 KVA G.E. 3/60/480 V. 3600 RPM, NON-CONDENSING nozzled for 150 psig. 5-10 psig back pressure.

BOILERS

1—50,000# Edgemoor bent tube 225# WP 490° TT Coxe chain grate stoker and economizer. New 1939.

2—502 HP Heine water leg type 200# WP 480° TT Coxe chain grate stokers. New 1929.

3—400 HP Babcock & Wilcox Sectional Header 225# WP.

DIESEL & GAS ENGINE UNITS

1—2000 HP Fairbanks Morse 6900 V. 60 cy.
1—1600 HP Fair. Morse 2300/4150 V. 60 cy.
1— 275 HP Ing. Rand 240 V. 60 cy. (Gas)
1— 250 HP Buckeye 240 V. 60 cy.

MOTOR GENERATOR SETS—60 CY.

QU.	KW	MFR.	V.—DC	A.C.	RPM
1	3000	G. E.	250	13200	514
1	1500	G. E.	600	4150	600
2	1000	West.	660	4150	900
1	200	West.	275	2200	900
2	150	G. E.	250	2300	1200
1	75	Ridgway	125	220	1200

SYNCHRONOUS MOTORS

QU.	HP	MFR.	VOLTAGE	RPM
2	2000	West.	13200	1200
2	700	West.	2300	200
1	600	G. E.	2300	240
1	300	G. E.	2300	600
1	300	West.	2300	900
4	125	G.E.	2300	720

FREQUENCY CHANGERS

QU.	KVA	MFR.	CYCLES	RPM
1	12500	G.E.	25/60	300
2	6875	West.	25/62½	375
1	3750	G.E.	25/60	300
1	3125	G.E.	25/60	300
1	2500	G.E.	25/62½	750
1	1875	A.C.	60/25	300

OIL CIRCUIT BREAKERS—Outdoor

4— 800 A. 132 KV West. G-222A-2500
1— 400 A. 73 KV Condit FO-40-250
2— 400 A. 37 KV G.E. FHKO-136-350
4— 600 A. 15 KV G.E. FHKO-139-750
1—1200 A. 15 KV G.E. FKO-139-350

TRANSFORMERS

4— 3333 KVA West. 69300/66000—33000
4— 2500 KVA Mol. 69000—13800
6— 2000 KVA G.E. 66000/114000—2400
4— 500 KVA West. 69000—6900
3— 400 KVA G.E. 66000/33000—2300/4160
3— 150 KVA Mol. 44000—2400/7200
3— 75 KVA West. 44000—7200/12470 Y
4— 5000 KVA G.E. 40935/70900 Y—14500
3— 3333 KVA G.E. 33000/11000—2400/7200
4— 333 KVA G.E. 33000—7200/12470Y
3— 200 KVA A.C. 33000—2400/7200/12470
3— 100 KVA West. 33000—240/480 NEW
3— 75 KVA Wag. 33000—7200/12470 Y
6— 2125 KVA G.E. 26400/13200—2300
4— 1500 KVA A.C. 25400/44000—6900/13800
4— 450 KVA A.C. 25410/44000—13280/23000
3— 1250 KVA G.E. 23000—2300/4000
3— 100 KVA G.E. 22000—7200/12470 Y
1— 3000 KVA Stand. 19050/33000—4150, 3 ph.
1— 5000 KVA Pitts. 13200—4600, 3 ph.
1— 450 KVA Penn. 13200—2400, 3 ph.
3— 250 KVA West. 13200—240/480
3— 200 KVA G.E. 13800—2300
3— 250 KVA Pitts. 7200—220/440
3— 100 KVA G.E. 7200—240/480
3— 150 KVA Wag. 6900—2300
3— 37½ KVA G.E. 6900—230/460
4— 150 KVA G.E. 4600/2400—240/120
3— 250 KVA G.E. 2300/4000 Y-115/230
3— 150 KVA West. 2400—230/115
1— 100 KVA G.E. 2300—575, 3 ph.
6— 50 KVA West. 2400—114/228 DRY TYPE

PARTIAL LIST ONLY

BREW, WOLTMAN & CO., INC.
50 Church St. — New York 7, N. Y.

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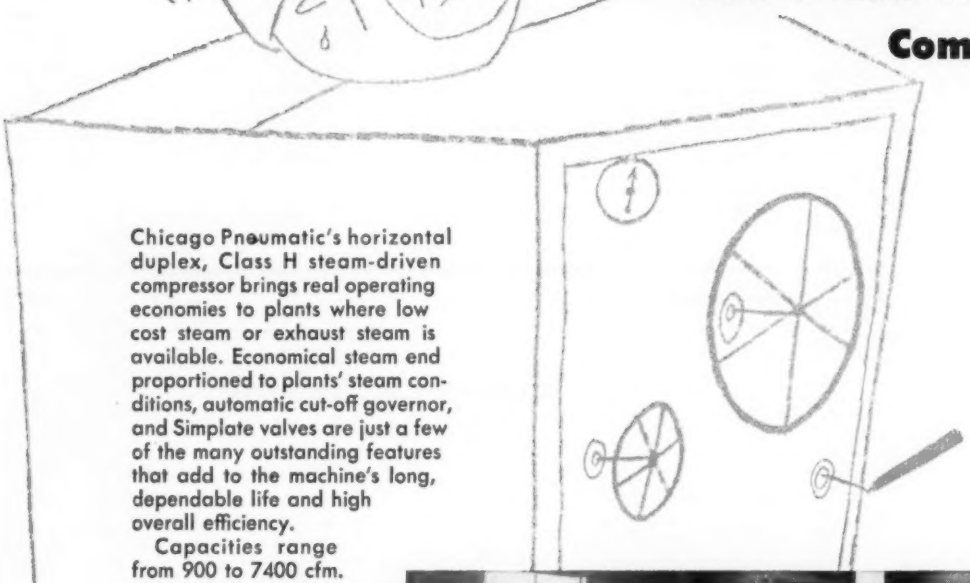

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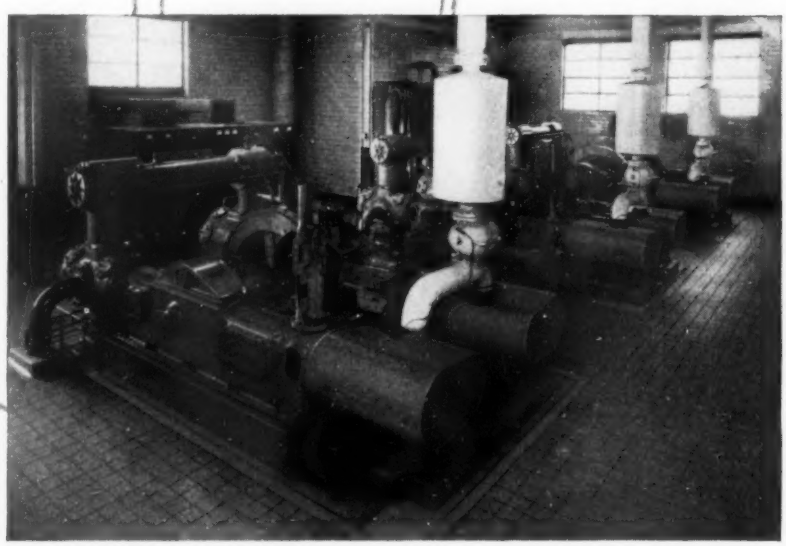

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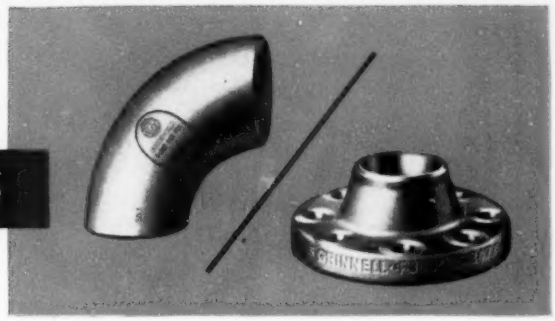

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Types 304, 347, 316

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Reducing Tee	5s, 10s, 40s, 80s	¾ to 12
Cross (Straight and Reducing)	5s, 10s, 40s, 80s	1¼ to 12
Concentric Reducer Eccentric Reducer	5s, 10s, 40s, 80s	¾ to 12
Lateral (Straight or Reducing)	5s, 10s, 40s, 80s	1 to 12
Cap	5s, 10s, 40s, 80s	½ to 12
Lap Joint Stub End-Long	10s, 40s, 80s	½ to 12
Lap Joint Stub End-Short	5s, 10s, 40s,	½ to 12

† 5s is Featherweight, 10s Lightweight, 40s Standard, 80s Extra Strong.
‡ Larger sizes available on special order.

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150 lb. and 300 lb. Steel Flange Standard *(Higher series available on application).*

DESCRIPTION	PIPE SIZE, IN.
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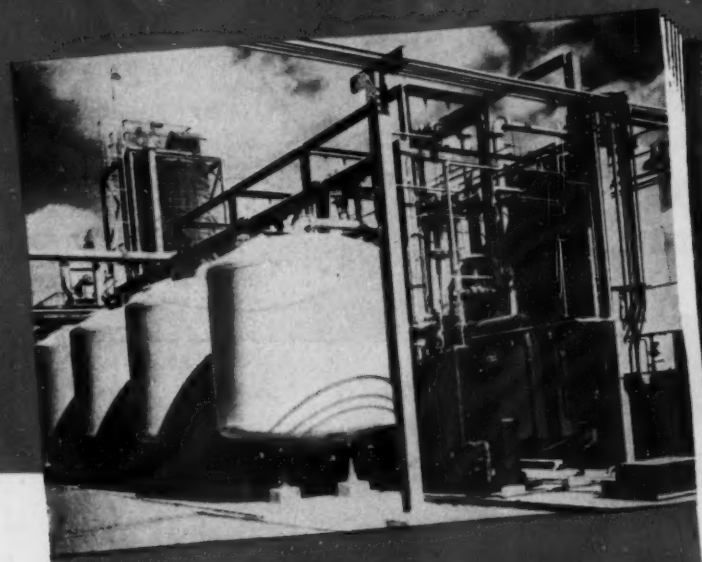

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